Tranquility® 20 (TS) Series

Models TSD/H/V 006 - 070
60Hz - HFC-410A

INSTALLATION, OPERATION & MAINTENANCE

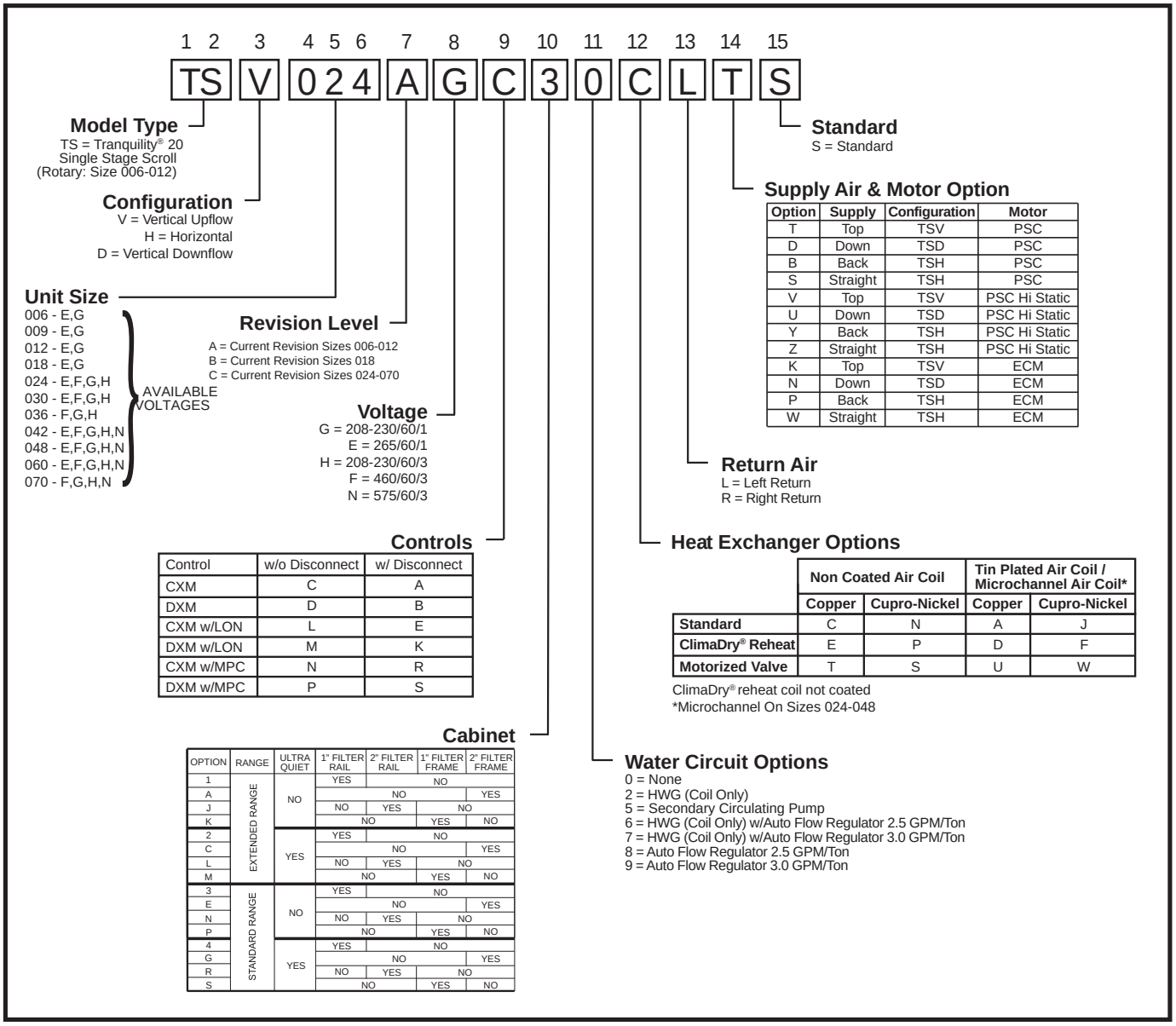
97B0075N06
Revised: 05 February, 2014

CLIMATEMASTER®
Water-Source Heat Pump Systems

Model Nomenclature - General Overview	3
General Information	4
Unit Physical Data	6
Horizontal Installation	7
Field Conversion of Air Discharge	9
Horizontal Installation	10
Vertical Installation	11
Piping Installation	13
Water-Loop Heat Pump Applications	14
Ground-Loop Heat Pump Applications	15
Ground-Water Heat Pump Applications	17
Water Quality Standards	19
Electrical - Line Voltage	20
Electrical - Power Wiring	26
Electrical - Power & Low Voltage Wiring	27
Electrical - Low Voltage Wiring	28
Electrical - Thermostat Wiring	29
TS Blower Performance Data - (ECM Motor) - Standard Unit - No Reheat	30
TS Blower Performance Data - Standard Unit - No Reheat (PSC Motor)	31
TS Blower Performance Data - Units with ClimaDry® (PSC Motor)	32
ECM Blower Control	33
Typical Wiring Diagram - Units with CXM Board and ECM Fan Motor (Single Phase)	35
Typical Wiring Diagram - Units with CXM Board and PSC Fan Motor (Single Phase)	36
CXM Controls	39
DXM Controls	40
Safety Features - CXM and DXM Controls	42
ClimaDry® Modulating Reheat Option	44
Piping System Cleaning and Flushing	47
Unit and System Checkout	49
Unit Start-Up Procedure	50
Unit Operating Conditions	52
ClimaDry® II Option Corrections (When Operating in Non-ClimaDry® Mode)	52
Preventive Maintenance	57
Functional Troubleshooting	58
Performance Troubleshooting	59
Start-Up Log Sheet	60
Functional Troubleshooting	61
Warranty (U.S. & Canada)	62
Warranty (International)	63
Revision History	64

This Page Intentionally Left Blank

Model Nomenclature - General Overview


1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
TS V 024 A G C 3 0 C L T S
Model Type
TS = Tranquility® 20
Single Stage Scroll
(Rotary: Size 006-012)
Configuration
V = Vertical Upflow
H = Horizontal
D = Vertical Downflow
Unit Size
006 - E,G
009 - E,G
012 - E,G
018 - E,G
024 - E,F,G,H
030 - E,F,G,H
036 - F,G,H
042 - E,F,G,H,N
048 - E,F,G,H,N
060 - E,F,G,H,N
070 - F,G,H,N
AVAILABLE VOLTAGES
Revision Level
A = Current Revision Sizes 006-012
B = Current Revision Sizes 018
C = Current Revision Sizes 024-070
Voltage
G = 208-230/60/1
E = 265/60/1
H = 208-230/60/3
F = 460/60/3
N = 575/60/3
Controls
Cabinet
Water Circuit Options
0 = None
2 = HWG (Coil Only)
5 = Secondary Circulating Pump
6 = HWG (Coil Only) w/Auto Flow Regulator 2.5 GPM/Ton
7 = HWG (Coil Only) w/Auto Flow Regulator 3.0 GPM/Ton
8 = Auto Flow Regulator 2.5 GPM/Ton
9 = Auto Flow Regulator 3.0 GPM/Ton
Heat Exchanger Options
Return Air
L = Left Return
R = Right Return
Supply Air & Motor Option
Standard
S = Standard

Control	w/o Disconnect	w/ Disconnect
CXM	C	A
DXM	D	B
CXM w/LON	L	E
DXM w/LON	M	K
CXM w/MPC	N	R
DXM w/MPC	P	S

OPTION	RANGE	ULTRA QUIET	1" FILTER RAIL	2" FILTER RAIL	1" FILTER FRAME	2" FILTER FRAME
1	EXTENDED RANGE	NO	YES	NO		
A			NO			YES
J			NO	YES	NO	
K			NO		YES	NO
2		YES	YES	NO		
C			NO			YES
L			NO	YES	NO	
M			NO		YES	NO
3	STANDARD RANGE	NO	YES	NO		
E			NO			YES
N			NO	YES	NO	
P			NO		YES	NO
4		YES	YES	NO		
G			NO			YES
R			NO	YES	NO	
S			NO		YES	NO

Option	Supply	Configuration	Motor
T	Top	TSV	PSC
D	Down	TSD	PSC
B	Back	TSH	PSC
S	Straight	TSH	PSC
V	Top	TSV	PSC Hi Static
U	Down	TSD	PSC Hi Static
Y	Back	TSH	PSC Hi Static
Z	Straight	TSH	PSC Hi Static
K	Top	TSV	ECM
N	Down	TSD	ECM
P	Back	TSH	ECM
W	Straight	TSH	ECM

	Non Coated Air Coil		Tin Plated Air Coil / Microchannel Air Coil*	
	Copper	Cupro-Nickel	Copper	Cupro-Nickel
Standard	C	N	A	J
ClimaDry® Reheat	E	P	D	F
Motorized Valve	T	S	U	W

ClimaDry® reheat coil not coated
*Microchannel On Sizes 024-048

Note: Above model nomenclature is a general reference. Consult individual engineering guides for detailed information.

ClimaDry® II Option Notes:

1. Unit must have DXM control option. 460 volt unit units require a four wire power supply with neutral.
2. ClimaDry® II may not be combined with motorized water valve, internal secondary circulating pump, or automatic flow regulator options.
3. Unit minimum entering air temperature while in the dehumidification, cooling, or continuous fan modes is **65ºF DB/55ºF WB**. Operation below this minimum may result in nuisance faults.
4. A thermostat with dehumidification mode or thermostat and separate humidistat/dehumidistat is required for activation and control of ClimaDry® II.
5. Downflow and 575 volt units are not eligible for ClimaDry® II.

Tranquility® 20 (TS) Series
Rev.:02/05/14

General Information

Safety
Warnings, cautions, and notices appear throughout this manual. Read these items carefully before attempting any installation, service, or troubleshooting of the equipment.

DANGER: Indicates an immediate hazardous situation, which if not avoided will result in death or serious injury. DANGER labels on unit access panels must be observed.

WARNING: Indicates a potentially hazardous situation, which if not avoided could result in death or serious injury.

CAUTION: Indicates a potentially hazardous situation or an unsafe practice, which if not avoided could result in minor or moderate injury or product or property damage.

NOTICE: Notification of installation, operation, or maintenance information, which is important, but which is not hazard-related.

⚠ WARNING! ⚠

WARNING! The EarthPure® Application and Service Manual should be read and understood before attempting to service refrigerant circuits with HFC-410A.

⚠ WARNING! ⚠

WARNING! To avoid the release of refrigerant into the atmosphere, the refrigerant circuit of this unit must be serviced only by technicians who meet local, state, and federal proficiency requirements.

⚠ CAUTION! ⚠

CAUTION! To avoid equipment damage, DO NOT use these units as a source of heating or cooling during the construction process. The mechanical components and filters will quickly become clogged with construction dirt and debris, which may cause system damage.

⚠ WARNING! ⚠

WARNING! The installation of water-source heat pumps and all associated components, parts, and accessories which make up the installation shall be in accordance with the regulations of ALL authorities having jurisdiction and MUST conform to all applicable codes. It is the responsibility of the installing contractor to determine and comply with ALL applicable codes and regulations.

⚠ WARNING! ⚠

WARNING! All refrigerant discharged from this unit must be recovered WITHOUT EXCEPTION. Technicians must follow industry accepted guidelines and all local, state, and federal statutes for the recovery and disposal of refrigerants. If a compressor is removed from this unit, refrigerant circuit oil will remain in the compressor. To avoid leakage of compressor oil, refrigerant lines of the compressor must be sealed after it is removed.

Inspection - Upon receipt of the equipment, carefully check the shipment against the bill of lading. Make sure all units have been received. Inspect the packaging of each unit, and inspect each unit for damage. Ensure that the carrier makes proper notation of any shortages or damage on all copies of the freight bill and completes a common carrier inspection report. Concealed damage not discovered during unloading must be reported to the carrier within 15 days of receipt of shipment. If not filed within 15 days, the freight company can deny the claim without recourse.

Note: It is the responsibility of the purchaser to file all necessary claims with the carrier. Notify your equipment supplier of all damage within fifteen (15) days of shipment.

Storage - Equipment should be stored in its original packaging in a clean, dry area. Store units in an upright position at all times. Stack units a maximum of 3 units high.

Unit Protection - Cover units on the job site with either the original packaging or an equivalent protective covering. Cap the open ends of pipes stored on the job site. In areas where painting, plastering, and/or spraying has not been completed, all due precautions must be taken to avoid physical damage to the units and contamination by foreign material. Physical damage and contamination may prevent proper start-up and may result in costly equipment clean-up.

Examine all pipes, fittings, and valves before installing any of the system components. Remove any dirt or debris found in or on these components.

General Information

Pre-Installation - Installation, Operation, and Maintenance instructions are provided with each unit. Horizontal equipment is designed for installation above false ceiling or in a ceiling plenum. Other unit configurations are typically installed in a mechanical room. The installation site chosen should include adequate service clearance around the unit. Before unit start-up, read all manuals and become familiar with the unit and its operation. Thoroughly check the system before operation.

Prepare units for installation as follows:

1. Compare the electrical data on the unit nameplate with ordering and shipping information to verify that the correct unit has been shipped.
2. Keep the cabinet covered with the original packaging until installation is complete and all plastering, painting, etc. is finished.
3. Verify refrigerant tubing is free of kinks or dents and that it does not touch other unit components.
4. Inspect all electrical connections. Connections must be clean and tight at the terminals.
5. Remove any blower support packaging (water-to-air units only).
6. Loosen compressor bolts on units equipped with compressor **spring** vibration isolation until the compressor rides freely on the springs. Remove shipping restraints. (No action is required for compressors with rubber grommets.)
7. Some airflow patterns are field convertible (horizontal units only). Locate the airflow conversion section of this IOM.
8. Locate and verify any hot water generator (HWG), hanger, or other accessory kit located in the compressor section or blower section.

⚠ CAUTION! ⚠

CAUTION! All three phase scroll compressors must have direction of rotation verified at start-up. Verification is achieved by checking compressor Amp draw. Amp draw will be substantially lower compared to nameplate values. Additionally, reverse rotation results in an elevated sound level compared to correct rotation. Reverse rotation will result in compressor internal overload trip within several minutes. Verify compressor type before proceeding.

⚠ CAUTION! ⚠

CAUTION! DO NOT store or install units in corrosive environments or in locations subject to temperature or humidity extremes (e.g., attics, garages, rooftops, etc.). Corrosive conditions and high temperature or humidity can significantly reduce performance, reliability, and service life. Always move and store units in an upright position. Tilting units on their sides may cause equipment damage.

⚠ CAUTION! ⚠

CAUTION! CUT HAZARD - Failure to follow this caution may result in personal injury. Sheet metal parts may have sharp edges or burrs. Use care and wear appropriate protective clothing, safety glasses and gloves when handling parts and servicing heat pumps.

NOTICE! Failure to remove shipping brackets from spring-mounted compressors will cause excessive noise, and could cause component failure due to added vibration.

Tranquility® 20 (TS) Series
Rev.:02/05/14

Unit Physical Data

Tranquility® 20 Single-Stage (TS) Series (60Hz)

Model	006	009	012	018	024	030	036	042	048	060	070
Compressor (1 Each)	Rotary			Scroll							
Factory Charge HFC-410A (oz) [kg]	24 [0.68]	32 [0.91]	34 [0.96]	50 [1.13]	41 [1.16]	41 [1.16]	48 [1.36]	68 [1.93]	68 [1.93]	136 [3.86]	141 [4.0]
ECM Fan Motor & Blower											
Blower Wheel Size (dia x w) - (in) [mm]	N/A	N/A	N/A	9 x 7 [229 x 178]	9 x 7 [229 x 178]	9 x 7 [229 x 178]	11 x 10 [279 x 254]	11 x 10 [279 x 254]	11 x 10 [279 x 254]	11 x 10 [279 x 254]	11 x 10 [279 x 254]
PSC Fan Motor & Blower (3 Speeds)											
Blower Wheel Size (dia x w) - (in) [mm]	6 X 5 [152 X 127]	6 X 5 [152 X 127]	6 X 5 [152 X 127]	9 x 7 [229 x 178]	9 x 7 [229 x 178]	9 x 7 [229 x 178]	10 x 10 [254 x 254]	10 x 10 [254 x 254]	10 x 10 [254 x 254]	11 x 10 [279 x 254]	11 x 10 [279 x 254]
Water Connection Size											
FPT (in)	1/2”	1/2”	1/2”	3/4”	3/4”	3/4”	3/4”	1”	1”	1”	1”
HWG Connection Size											
FPT (in)	N/A	N/A	N/A	1/2”	1/2”	1/2”	1/2”	1/2”	1/2”	1/2”	1/2”
Coax Volume											
Volume (US Gallons) [liters]	0.17 [0.64]	0.29 [1.10]	0.45 [1.70]	0.56 [2.12]	0.76 [2.88]	0.76 [2.88]	0.92 [3.48]	1.24 [4.69]	1.24 [4.69]	1.56 [5.91]	1.56 [5.91]
Vertical Upflow/Downflow											
Air Coil Dimensions (h x w) - (in) [mm]	16 x 16 [406 x 406] Upflow Only	16 x 16 [406 x 406] Upflow Only	16 x 16 [406 x 406] Upflow Only	24 x 20 [610 x 508]	28 x 20 [711 x 508]	28 x 20 [711 x 508]	28 x 25 [711 x 635]	32 x 25 [813 x 635]	32 x 25 [813 x 635]	36 x 25 [914 x 635]	36 x 25 [914 x 635]
Standard Filter - 1” [25.4mm] Throwaway, qty (in) [mm]	16 x 20 [406 x 508]	16 x 20 [406 x 508]	16 x 20 [406 x 508]	24 x 24 [610 x 610]	28 x 24 [711 x 610]	28 x 24 [711 x 610]	28 x 30 [711 x 762]	2 - 16 x 30 [2 - 406 x 762]	2 - 16 x 30 [2 - 406 x 762]	1 - 16 x 30; 1 - 20 x 30 [1 - 406 x 762; 1 - 508 x 762]	1 - 16 x 30; 1 - 20 x 30 [1 - 406 x 762; 1 - 508 x 762]
Weight - Operating, (lbs) [kg]	136 [62]	156 [71]	160 [73]	257 [117]	266 [121]	268 [122]	327 [148]	414 [188]	416 [189]	441 [200]	443 [201]
Weight - Packaged, (lbs) [kg]	146 [66]	166 [75]	170 [77]	267 [121]	276 [125]	278 [126]	337 [153]	424 [192]	426 [193]	451 [205]	453 [205]
Horizontal											
Air Coil Dimensions (h x w) - (in) [mm]	16 x 16 [406 x 406]	16 x 16 [406 x 406]	16 x 16 [406 x 406]	18 x 27 [457 x 686]	18 x 31 [457 x 787]	18 x 31 [457 x 787]	20 x 35 [508 x 889]	20 x 40 [508 x 1016]	20 x 40 [508 x 1016]	20 x 45 [508 x 1143]	20 x 45 [508 x 1143]
Standard Filter - 1” [25.4mm] Throwaway, qty (in) [mm]	16 x 20 [406 x 508]	16 x 20 [406 x 508]	16 x 20 [406 x 508]	2 - 18 x 18 [2 - 457 x 457]	2 - 18 x 18 [2 - 457 x 457]	2 - 18 x 18 [2 - 457 x 457]	1 - 12 x 20; 1- 20 x 25 [1 - 305 x 508; 1 - 508 x 635]	1 - 18 x 20; 1 - 20 x 24 [1 - 457 x 508; 1 - 508 x 610]	1 - 18 x 20; 1 - 20 x 24 [1 - 457 x 508; 1 - 508 x 610]	2 - 20 x 24 [2 - 508 x 610]	2 - 20 x 24 [2 - 508 x 610]
Weight - Operating, (lbs) [kg]	136 [62]	156 [71]	160 [73]	257 [117]	266 [121]	268 [122]	327 [148]	414 [188]	416 [189]	441 [200]	443 [201]
Weight - Packaged, (lbs) [kg]	146 [66]	166 [75]	170 [77]	267 [121]	276 [125]	278 [126]	337 [153]	424 [192]	426 [193]	451 [205]	453 [205]

Notes:
All units have TXV expansion device and 1/2” & 3/4” electrical knockouts.
575 volt motors are two speed.
For units with ClimaDry® II option add 66lbs (30kg) to weights.

Unit Maximum Water Working Pressure	
Options	Max Pressure PSIG [kPa]
Base Unit	300 [2,068]
Internal Secondary Pump (ISP)	145 [999]
ClimaDry®	145 [999]
Internal Motorized Water Valve (MWV)	300 [2,068]
Internal Auto Flow Valve	300 [2,068]

Use the lowest maximum pressure rating when multiple options are combined.

Horizontal Installation

Horizontal Unit Location

Units are not designed for outdoor installation. Locate the unit in an INDOOR area that allows enough space for service personnel to perform typical maintenance or repairs without removing unit from the ceiling. Horizontal units are typically installed above a false ceiling or in a ceiling plenum. Never install units in areas subject to freezing or where humidity levels could cause cabinet condensation (such as unconditioned spaces subject to 100% outside air). Consideration should be given to access for easy removal of the filter and access panels. Provide sufficient room to make water, electrical, and duct connection(s).

If the unit is located in a confined space, such as a closet, provisions must be made for return air to freely enter the space by means of a louvered door, etc. Any access panel screws that would be difficult to remove after the unit is installed should be removed prior to setting the unit. Refer to Figure 3 for an illustration of a typical installation. Refer to unit submittal data or engineering design guide for dimensional data.

Conform to the following guidelines when selecting unit location:

1. Provide a hinged access door in concealed-spline or plaster ceilings. Provide removable ceiling tiles in T-bar or lay-in ceilings. Refer to horizontal unit dimensions for specific series and model in unit submittal data. Size the access opening to accommodate the service technician during the removal or replacement of the compressor and the removal or installation of the unit itself.
2. Provide access to hanger brackets, water valves and fittings. Provide screwdriver clearance to access panels, discharge collars and all electrical connections.
3. DO NOT obstruct the space beneath the unit with piping, electrical cables and other items that prohibit future removal of components or the unit itself.
4. Use a manual portable jack/lift to lift and support the weight of the unit during installation and servicing.

The installation of water source heat pump units and all associated components, parts and accessories which make up the installation shall be in accordance with the regulations of ALL authorities having jurisdiction and MUST conform to all applicable codes. It is the responsibility of the installing contractor to determine and comply with ALL applicable codes and regulations.

Mounting Horizontal Units

Horizontal units have hanger kits pre-installed from the factory as shown in Figure 1. Figure 3 shows a typical horizontal unit installation.

Horizontal heat pumps are typically suspended above a ceiling or within a soffit using field supplied, threaded rods sized to support the weight of the unit.

Use four (4) field supplied threaded rods and factory provided vibration isolators to suspend the unit. Hang the unit clear of the floor slab above and support the unit by the mounting bracket assemblies only. DO NOT attach the unit flush with the floor slab above.

Pitch the unit toward the drain as shown in Figure 2 to improve the condensate drainage. On small units (less than 2.5 tons/8.8kW) ensure that unit pitch does not cause condensate leaks inside the cabinet.

Figure 1: Hanger Bracket

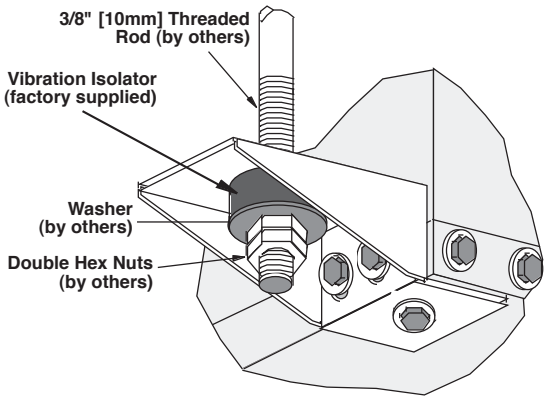
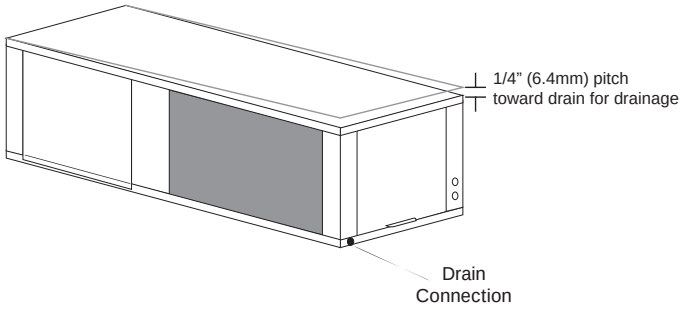
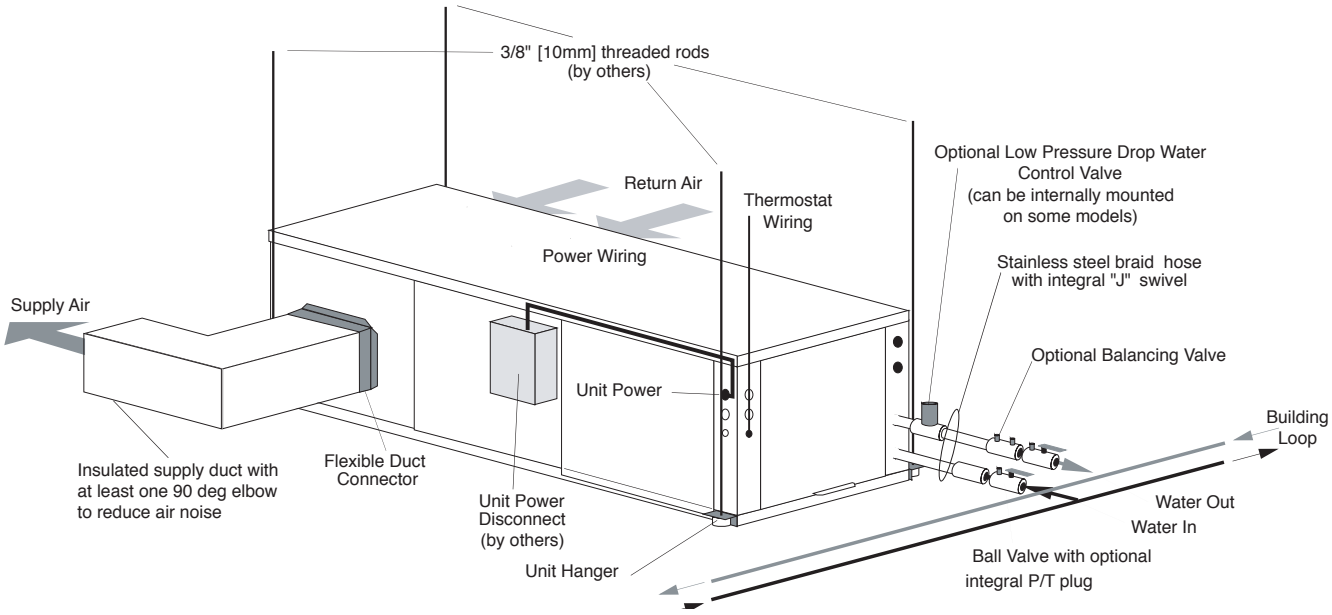


Figure 2: Horizontal Unit Pitch



Horizontal Installation

Figure 3: Typical Horizontal Unit Installation



Air Coil - To obtain maximum performance, the air coil should be cleaned before start-up. A 10% solution of dishwasher detergent and water is recommended for both sides of the coil. A thorough water rinse should follow. **UV based anti-bacterial systems may damage coated air coils.**

Notice! Installation Note - Ducted Return: Many horizontal WSHPs are installed in a return air ceiling plenum application (above ceiling). Vertical WSHPs are commonly installed in a mechanical room with free return (e.g. louvered door). Therefore, filter rails are the industry standard and are included on ClimateMaster commercial heat pumps for the purposes of holding the filter only. For ducted return applications, the filter rail must be removed and replaced with a duct flange or filter rack. Canvas or flexible connectors should also be used to minimize vibration between the unit and ductwork.

Field Conversion of Air Discharge

Overview - Horizontal units can be field converted between side (straight) and back (end) discharge using the instructions below.

Note: It is not possible to field convert return air between left or right return models due to the necessity of refrigeration copper piping changes.

Preparation - It is best to field convert the unit on the ground before hanging. If the unit is already hung it should be taken down for the field conversion.

Side to Back Discharge Conversion

1. Place unit in well lit area. Remove the screws as shown in Figure 4 to free top panel and discharge panel.
2. Lift out the access panel and set aside. Lift and rotate the discharge panel to the other position as shown, being careful with the blower wiring.
3. Check blower wire routing and connections for tension or contact with sheet metal edges. Re-route if necessary.
4. Check refrigerant tubing for contact with other components.
5. Reinstall top panel and screws noting that the location for some screws will have changed.
6. Manually spin the fan wheel to ensure that the wheel is not rubbing or obstructed.
7. Replace access panels.

Back to Side Discharge Conversion - If the discharge is changed from back to side, use above instruction noting that illustrations will be reversed.

Left vs. Right Return - It is not possible to field convert return air between left or right return models due to the necessity of refrigeration copper piping changes. However, the conversion process of side to back or back to side discharge for either right or left return configuration is the same. In some cases, it may be possible to rotate the entire unit 180 degrees if the return air connection needs to be on the opposite side. **Note that rotating the unit will move the piping to the other end of the unit.**

Figure 4: Left Return Side to Back

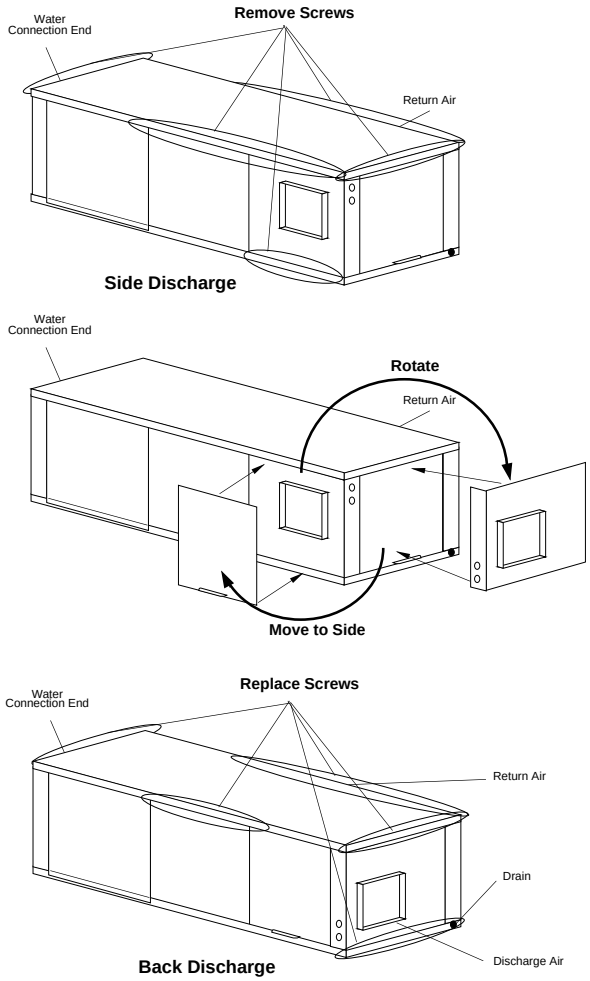
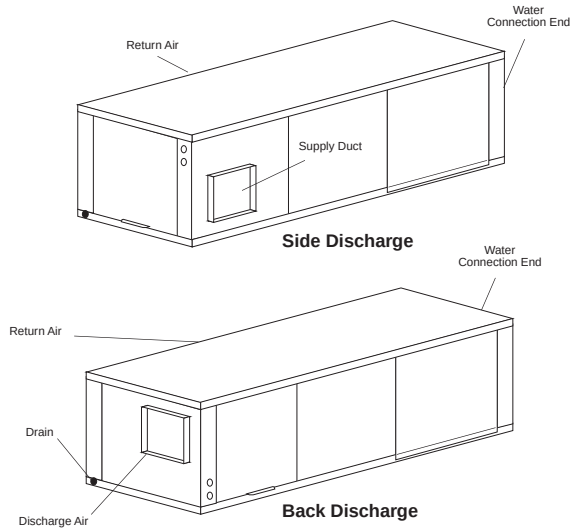


Figure 5: Right Return Side to Back



Horizontal Installation

Condensate Piping - Horizontal Units - A condensate drain line must be installed and pitched away for the unit to allow for proper drainage. This connection must meet all local plumbing/building codes.

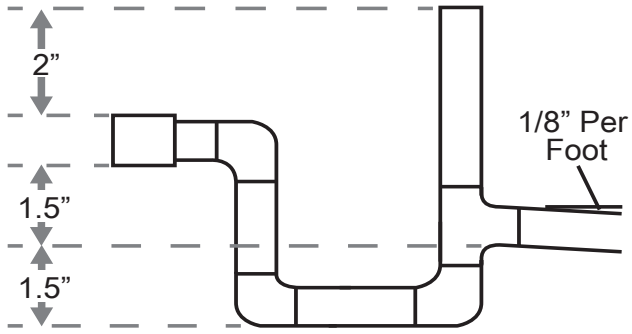
Pitch the unit toward the drain as shown in Figure 2 to improve the condensate drainage. On small units (less than 2.5 tons/8.8 kW), ensure that unit pitch does not cause condensate leaks inside the cabinet.

Install condensate trap at each unit with the top of the trap positioned below the unit condensate drain connection as shown in Figure 6. Design the depth of the trap (water-seal) based upon the amount of ESP capability of the blower (where 2 inches [51mm] of ESP capability requires 2 inches [51mm] of trap depth). As a general rule, 1-1/2 inch [38mm] trap depth is the minimum.

Each unit must be installed with its own individual trap and connection to the condensate line (main) or riser. Provide a means to flush or blow out the condensate line. DO NOT install units with a common trap and/or vent.

Always vent the condensate line when dirt or air can collect in the line or a long horizontal drain line is required. Also vent when large units are working against higher external static pressure than other units connected to the same condensate main since this may cause poor drainage for all units on the line. **WHEN A VENT IS INSTALLED IN THE DRAIN LINE, IT MUST BE LOCATED AFTER THE TRAP IN THE DIRECTION OF THE CONDENSATE FLOW.**

Figure 6: Horizontal Condensate Connection



* Some units include a painted drain connection. Using a threaded pipe or similar device to clear any excess paint accumulated inside this fitting may ease final drain line installation.

⚠ CAUTION! ⚠

CAUTION! Ensure condensate line is pitched toward drain 1/8” per ft [11mm per m] of run.

Duct System Installation - Proper duct sizing and design is critical to the performance of the unit. The duct system should be designed to allow adequate and even airflow through the unit during operation. Air flow through the unit MUST be at or above the minimum stated airflow for the unit to avoid equipment damage. Duct systems should be designed for quiet operation. Refer to Figure 3 for horizontal duct system details or Figure 8 for vertical duct system details. A flexible connector is recommended for both discharge and return air duct connections on metal duct systems to eliminate the transfer of vibration to the duct system. To maximize sound attenuation of the unit blower, the supply and return plenums should include internal fiberglass duct liner or be constructed from ductboard for the first few feet. Application of the unit to uninsulated ductwork in an unconditioned space is not recommended, as the unit’s performance may be adversely affected.

At least one 90° elbow should be included in the supply duct to reduce air noise. If air noise or excessive air flow is a problem, the blower speed can be changed. For airflow charts, consult submittal data for the series and model of the specific unit.

If the unit is connected to existing ductwork, a previous check should have been made to ensure that the ductwork has the capacity to handle the airflow required for the unit. If ducting is too small, as in the replacement of a heating only system, larger ductwork should be installed. All existing ductwork should be checked for leaks and repaired as necessary.

Vertical Installation

Vertical Unit Location - Units are not designed for outdoor installation. Locate the unit in an INDOOR area that allows enough space for service personnel to perform typical maintenance or repairs without removing unit from the mechanical room/closet. Vertical units are typically installed in a mechanical room or closet. Never install units in areas subject to freezing or where humidity levels could cause cabinet condensation (such as unconditioned spaces subject to 100% outside air). Consideration should be given to access for easy removal of the filter and access panels. Provide sufficient room to make water, electrical, and duct connection(s).

If the unit is located in a confined space, such as a closet, provisions must be made for return air to freely enter the space by means of a louvered door, etc. Any access panel screws that would be difficult to remove after the unit is installed should be removed prior to setting the unit. Refer to Figures 7 and 8 for typical installation illustrations. Refer to unit submittal data or engineering design guide for dimensional data.

1. Install the unit on a piece of rubber, neoprene orother mounting pad material for sound isolation. The pad should be at least 3/8" [10mm] to 1/2" [13mm] in thickness. Extend the pad beyond all four edges of the unit.
2. Provide adequate clearance for filter replacement and drain pan cleaning. Do not block filter access with piping, conduit or other materials. Refer to unit submittal data or engineering design guide for dimensional data.
3. Provide access for fan and fan motor maintenance and for servicing the compressor and coils without removing the unit.
4. Provide an unobstructed path to the unit within the closet or mechanical room. Space should be sufficient to allow removal of the unit, if necessary.
5. Provide access to water valves and fittings and screwdriver access to the unit side panels, discharge collar and all electrical connections.

Notice! Installation Note - Ducted Return: Many horizontal WSHPs are installed in a return air ceiling plenum application (above ceiling). Vertical WSHPs are commonly installed in a mechanical room with free return (e.g. louvered door). Therefore, filter rails are the industry standard and are included on ClimateMaster commercial heat pumps for the purposes of holding the filter only. For ducted return applications, the filter rail must be removed and replaced with a duct flange or filter rack. Canvas or flexible connectors should also be used to minimize vibration between the unit and ductwork.

Figure 7: Vertical Unit Mounting

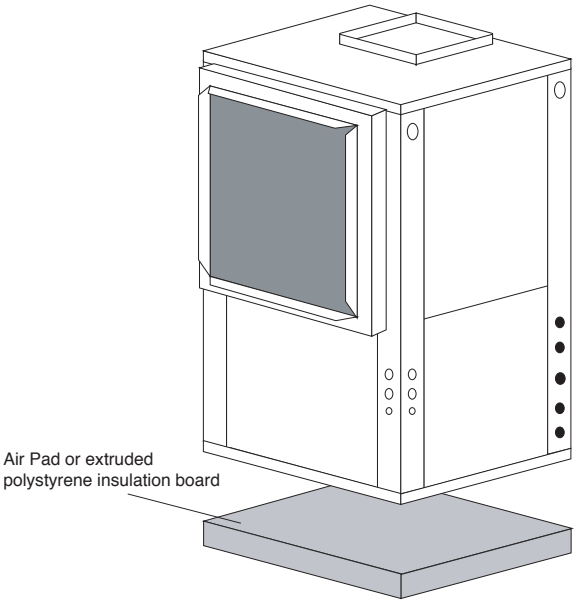
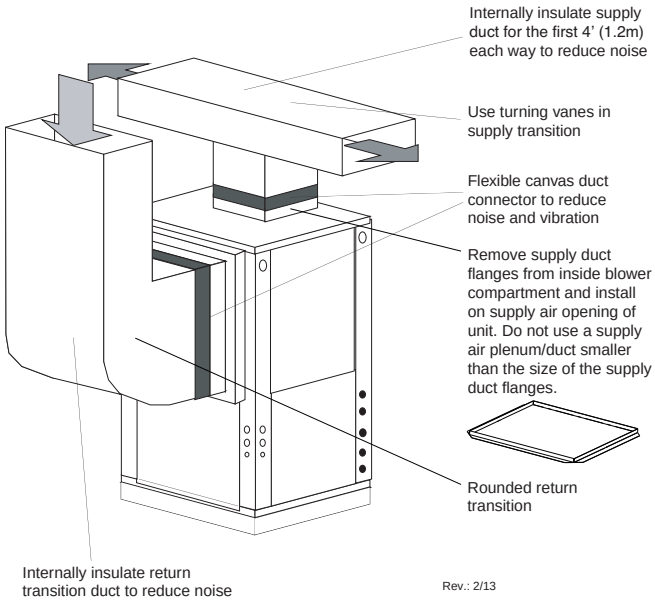


Figure 8: Typical Vertical Unit Installation Using Ducted Return Air

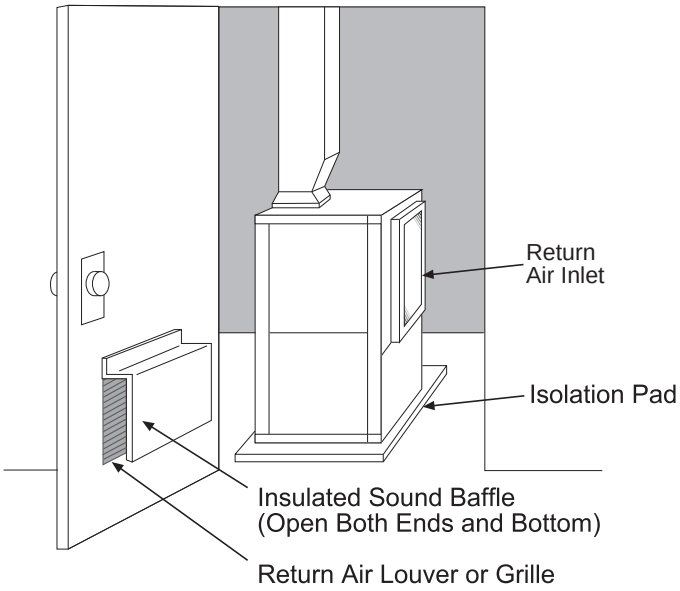

Internally insulate supply duct for the first 4' (1.2m) each way to reduce noise
Use turning vanes in supply transition
Flexible canvas duct connector to reduce noise and vibration
Remove supply duct flanges from inside blower compartment and install on supply air opening of unit. Do not use a supply air plenum/duct smaller than the size of the supply duct flanges.
Rounded return transition
Internally insulate return transition duct to reduce noise
Rev.: 2/13

Vertical Installation

Sound Attenuation for Vertical Units - Sound attenuation is achieved by enclosing the unit within a small mechanical room or a closet. Additional measures for sound control include the following:

1. Mount the unit so that the return air inlet is 90° to the return air grille. Refer to Figure 9. Install a sound baffle as illustrated to reduce line-of sight sound transmitted through return air grilles.
2. Mount the unit on a rubber or neoprene isolation pad to minimize vibration transmission to the building structure.

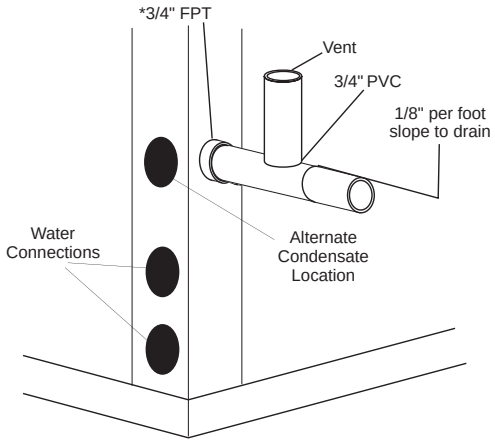
Figure 9: Vertical Sound Attenuation



Notice! Units with clear plastic drain lines should have regular maintenance (as required) to avoid buildup of debris, especially in new construction.

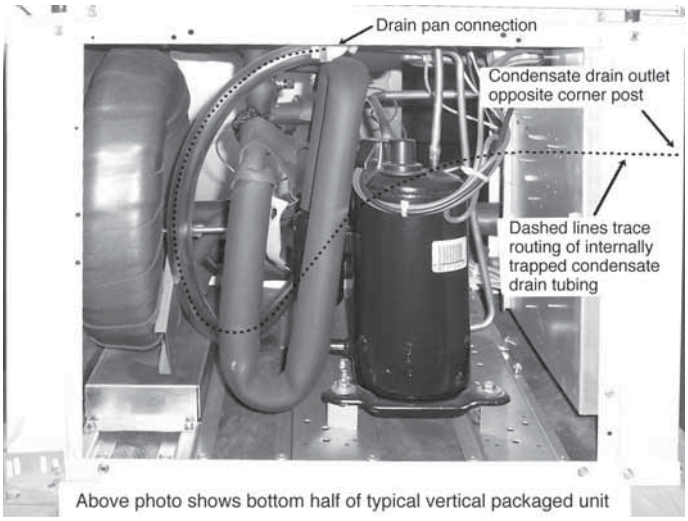
Condensate Piping for Vertical Units - A condensate line must be installed and pitched away from the unit to allow for proper drainage. This connection must meet all local plumbing/building codes. Vertical units utilize a condensate hose inside the cabinet as a trapping loop; therefore an external trap is not necessary. Figure 10a shows typical condensate connections. Figure 10b illustrates the internal trap for a typical vertical heat pump. Each unit must be installed with its own individual vent (where necessary) and a means to flush or blow out the condensate drain line. Do not install units with a common trap and/or vent.

Figure 10a: Vertical Condensate Drain



* Some units include a painted drain connection. Using a threaded pipe or similar device to clear any excess paint accumulated inside this fitting may ease final drain line installation.

Figure 10b: Vertical Internal Condensate Trap



Above photo shows bottom half of typical vertical packaged unit

Piping Installation

Installation of Supply and Return Piping
Follow these piping guidelines.

1. Install a drain valve at the base of each supply and return riser to facilitate system flushing.
2. Install shut-off / balancing valves and unions at each unit to permit unit removal for servicing.
3. Place strainers at the inlet of each system circulating pump.
4. Select the proper hose length to allow slack between connection points. Hoses may vary in length by +2% to -4% under pressure.
5. Refer to Table 1. Do not exceed the minimum bend radius for the hose selected. Exceeding the minimum bend radius may cause the hose to collapse, which reduces water flow rate. Install an angle adapter to avoid sharp bends in the hose when the radius falls below the required minimum.

Insulation is not required on loop water piping except where the piping runs through unheated areas, outside the building or when the loop water temperature is below the minimum expected dew point of the pipe ambient conditions. Insulation is required if loop water temperature drops below the dew point (insulation is required for ground loop applications in most climates).

Pipe joint compound is not necessary when Teflon® thread tape is pre-applied to hose assemblies or when flared-end connections are used. If pipe joint compound is preferred, use compound only in small amounts on the external pipe threads of the fitting adapters. Prevent sealant from reaching the flared surfaces of the joint.

Note: When antifreeze is used in the loop, ensure that it is compatible with the Teflon® tape or pipe joint compound that is applied.

Maximum allowable torque for brass fittings is 30 ft-lbs [41 N-m]. If a torque wrench is not available, tighten finger-tight plus one quarter turn. Tighten steel fittings as necessary.

Optional pressure-rated hose assemblies designed specifically for use with ClimateMaster units are available. Similar hoses can be obtained from alternate suppliers. Supply and return hoses are fitted with swivel-joint fittings at one end to prevent kinking during installation.

Refer to Figure 11 for an illustration of a typical supply/return hose kit. Adapters secure hose assemblies to the unit and risers. Install hose assemblies properly and check regularly to avoid system failure and reduced service life.

Installer Caution: After making water connections on units equipped with ClimaDry®, ensure the three union nuts on the internal three-way water valve are tight.

ClimaDry®-equipped units have a manual air bleed valve at the top of the reheat coil. This valve must be used to bleed the air from the reheat coil after filling the system, for the ClimaDry® to operate properly.

⚠ WARNING! ⚠

WARNING! Polyolester Oil, commonly known as POE oil, is a synthetic oil used in many refrigeration systems including those with HFC-410A refrigerant. POE oil, if it ever comes in contact with PVC or CPVC piping, may cause failure of the PVC/CPVC. PVC/CPVC piping should never be used as supply or return water piping with water source heat pump products containing HFC-410A as system failures and property damage may result.

⚠ CAUTION! ⚠

CAUTION! Corrosive system water requires corrosion resistant fittings and hoses, and may require water treatment.

⚠ CAUTION! ⚠

CAUTION! Do not bend or kink supply lines or hoses.

⚠ CAUTION! ⚠

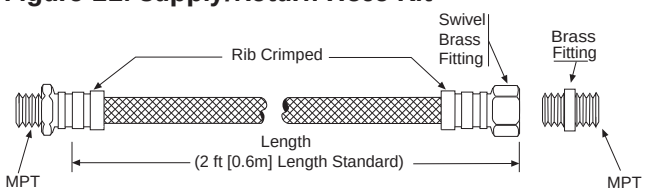
CAUTION! Piping must comply with all applicable codes.

Table 1: Metal Hose Minimum Bend Radii

Hose Diameter	Minimum Bend Radii
1/2" [12.7mm]	2-1/2" [6.4cm]
3/4" [19.1mm]	4" [10.2cm]
1" [25.4mm]	5-1/2" [14cm]
1-1/4" [31.8mm]	6-3/4" [17.1cm]

NOTICE! Do not allow hoses to rest against structural building components. Compressor vibration may be transmitted through the hoses to the structure, causing unnecessary noise complaints.

Figure 11: Supply/Return Hose Kit



Water-Loop Heat Pump Applications

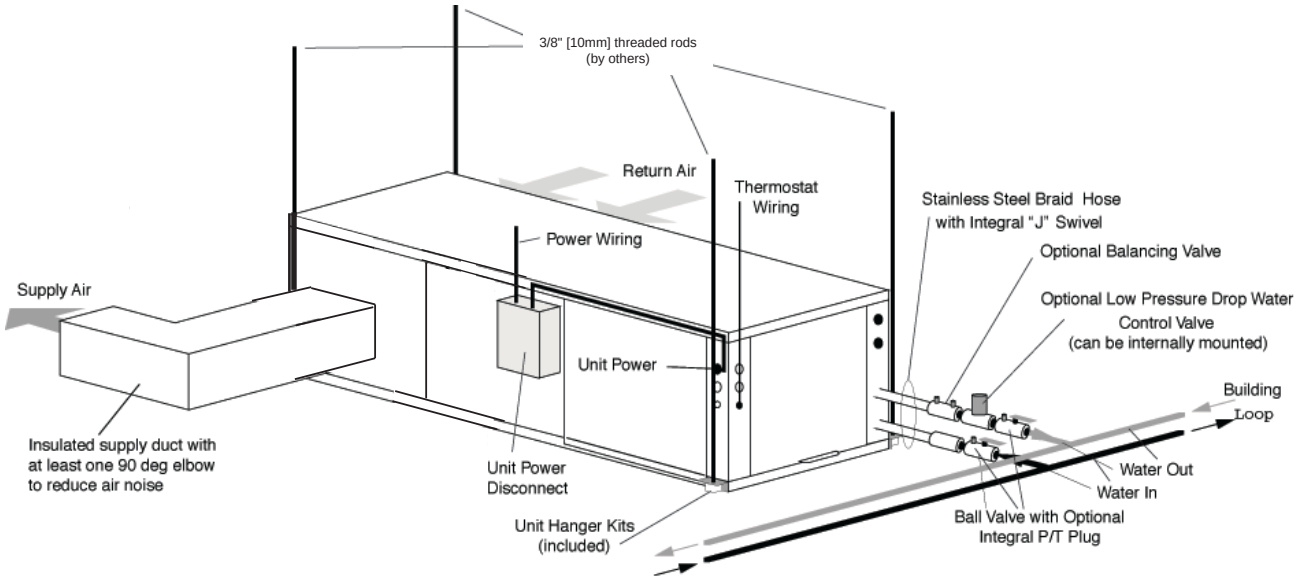
Commercial Water Loop Applications
Commercial systems typically include a number of units connected to a common piping system. Any unit plumbing maintenance work can introduce air into the piping system; therefore air elimination equipment is a major portion of the mechanical room plumbing. Consideration should be given to insulating the piping surfaces to avoid condensation. ClimateMaster recommends unit insulation any time the water temperature is expected to be below 60ºF (15.6ºC). Metal to plastic threaded joints should never be used due to their tendency to leak over time.

Teflon® tape thread sealant is recommended to minimize internal fouling of the heat exchanger. Do not over tighten connections and route piping so as not to interfere with service or maintenance access. Hose kits are available from ClimateMaster in different configurations as shown in Figure 12 for connection between the unit and the piping system. Depending upon selection, hose kits may include shut off valves, P/T plugs for performance measurement, high pressure stainless steel braided hose, "Y" type strainer with blow down valve, and/or "J" type swivel connection. Balancing valves and an external low pressure drop solenoid valve for use in variable speed pumping systems may also be included in the hose kit.

The piping system should be flushed to remove dirt, piping chips, and other foreign material prior to operation (see "Piping System Cleaning and Flushing Procedures" in this manual). The flow rate is usually set between 2.25 and 3.5 gpm per ton [2.9 and 4.5 l/m per kW] of cooling capacity. ClimateMaster recommends 3 gpm per ton [3.9 l/m per kW] for most applications of water loop heat pumps. To ensure proper maintenance and servicing, P/T ports are imperative for temperature and flow verification, as well as performance checks.

Water loop heat pump (cooling tower/boiler) systems typically utilize a common loop, maintained between 60 - 90°F [16 - 32°C]. The use of a closed circuit evaporative cooling tower with a secondary heat exchanger between the tower and the water loop is recommended. If an open type cooling tower is used continuously, chemical treatment and filtering will be necessary.

Figure 12: Typical Water-Loop Application



Low Water Temperature Cutout Setting - CXM Control
When antifreeze is selected, the LT1 jumper (JW3) should be clipped to select the low temperature (antifreeze 10.0°F [-12.2°C]) setpoint and avoid nuisance faults (see "Low Water Temperature Cutout Selection" in this manual).
Note: Low water temperature operation requires extended range equipment.

Ground-Loop Heat Pump Applications

⚠ CAUTION! ⚠

CAUTION! The following instructions represent industry accepted installation practices for closed loop earth coupled heat pump systems. Instructions are provided to assist the contractor in installing trouble free ground loops. These instructions are recommendations only. State/provincial and local codes MUST be followed and installation MUST conform to ALL applicable codes. It is the responsibility of the installing contractor to determine and comply with ALL applicable codes and regulations.

⚠ CAUTION! ⚠

CAUTION! Ground loop applications require extended range equipment and optional refrigerant/water circuit insulation.

Pre-Installation

Prior to installation, locate and mark all existing underground utilities, piping, etc. Install loops for new construction before sidewalks, patios, driveways, and other construction has begun. During construction, accurately mark all ground loop piping on the plot plan as an aid in avoiding potential future damage to the installation.

Piping Installation

The typical closed loop ground source system is shown in Figure 13. All earth loop piping materials should be limited to polyethylene fusion only for in-ground sections of the loop. Galvanized or steel fittings should not be used at any time due to their tendency to corrode. All plastic to metal threaded fittings should be avoided due to their potential to leak in earth coupled applications. A flanged fitting should be substituted. P/T plugs should be used so that flow can be measured using the pressure drop of the unit heat exchanger.

Earth loop temperatures can range between 25 and 110°F [-4 to 43°C]. Flow rates between 2.25 and 3 gpm [2.41 to 3.23 l/m per kW] of cooling capacity is recommended in these applications.

Test individual horizontal loop circuits before backfilling. Test vertical U-bends and pond loop assemblies prior to installation. Pressures of at least 100 psi [689 kPa] should be used when testing. Do not exceed the pipe pressure rating. Test entire system when all loops are assembled.

Flushing the Earth Loop

Upon completion of system installation and testing, flush the system to remove all foreign objects and purge to remove all air.

Antifreeze

In areas where minimum entering loop temperatures drop below 40°F [5°C] or where piping will be routed through areas subject to freezing, antifreeze is required. Alcohols and glycols are commonly used as antifreeze; however your local sales office should be consulted to determine the antifreeze best suited to your area. Freeze protection should be maintained to 15°F [9°C] below the lowest expected entering loop temperature. For example, if 30°F [-1°C] is the minimum expected entering loop temperature, the leaving loop temperature would be 22 to 25°F [-6 to -4°C] and freeze protection should be at 15°F [-10°C]. Calculation is as follows:
30°F - 15°F = 15°F [-1°C - 9°C = -10°C].

All alcohols should be premixed and pumped from a reservoir outside of the building when possible or introduced under the water level to prevent fumes. Calculate the total volume of fluid in the piping system. Then use the percentage by volume shown in table 2 for the amount of antifreeze needed. Antifreeze concentration should be checked from a well mixed sample using a hydrometer to measure specific gravity.

Low Water Temperature Cutout Setting - CXM Control

When antifreeze is selected, the LT1 jumper (JW3) should be clipped to select the low temperature (antifreeze 10.0°F [-12.2°C]) setpoint and avoid nuisance faults (see "Low Water Temperature Cutout Selection" in this manual). **Note: Low water temperature operation requires extended range equipment.**

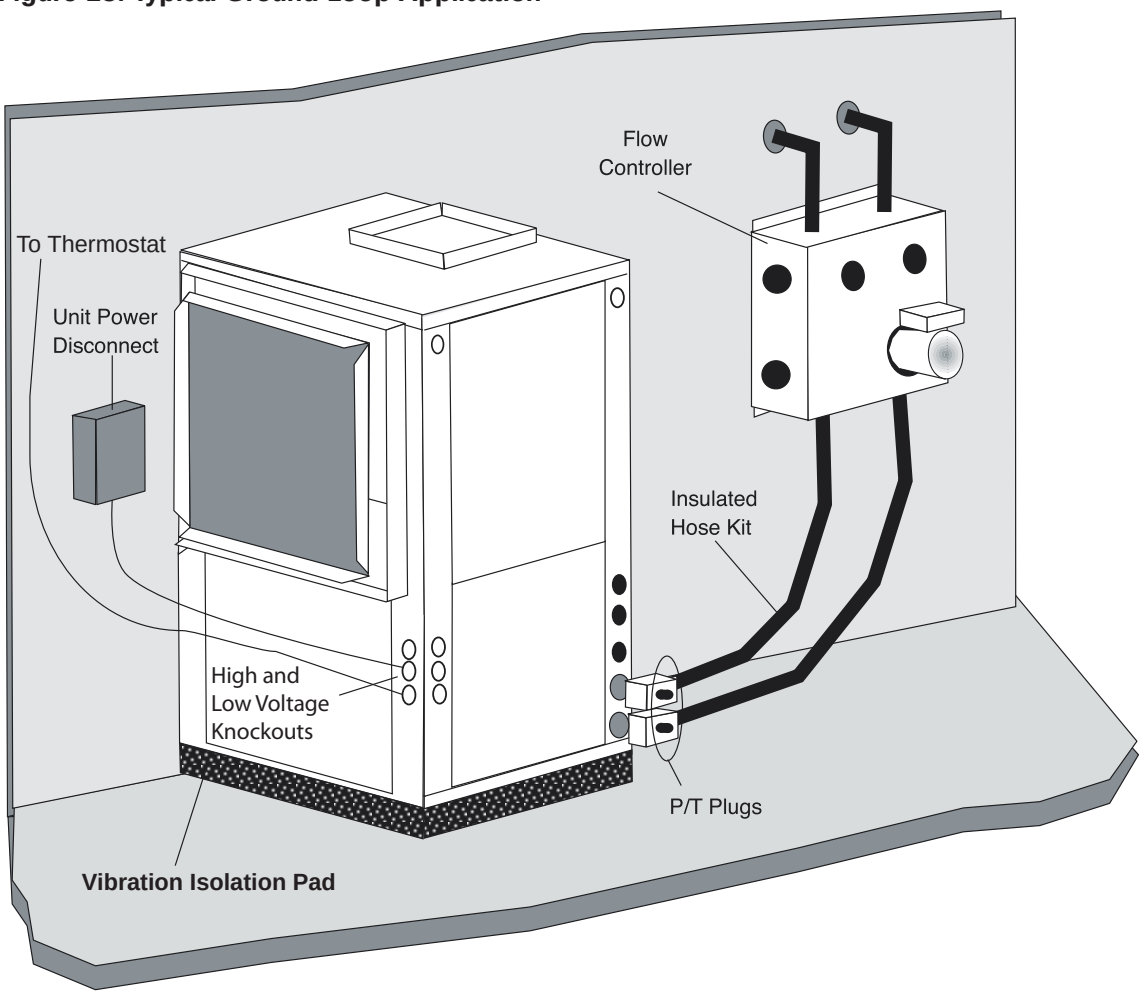
Table 2: Antifreeze Percentages by Volume

Type	Minimum Temperature for Low Temperature Protection			
	10°F [-12.2°C]	15°F [-9.4°C]	20°F [-6.7°C]	25°F [-3.9°C]
Methanol	25%	21%	16%	10%
100% USP food grade Propylene Glycol	38%	25%	22%	15%
Ethanol*	29%	25%	20%	14%

* Must not be denatured with any petroleum based product

Ground-Loop Heat Pump Applications

Figure 13: Typical Ground-Loop Application



Ground-Water Heat Pump Applications

Open Loop - Ground Water Systems - Typical open loop piping is shown in Figure 14. Shut off valves should be included for ease of servicing. Boiler drains or other valves should be "tee'd" into the lines to allow acid flushing of the heat exchanger. Shut off valves should be positioned to allow flow through the coax via the boiler drains without allowing flow into the piping system. P/T plugs should be used so that pressure drop and temperature can be measured. Supply and return water piping materials should be limited to copper, PE, or similar material. PVC or CPVC should never be used as they are incompatible with the POE oils used in HFC-410A products and piping system failure and property damage may result.

⚠ WARNING! ⚠

WARNING! Polyolester Oil, commonly known as POE oil, is a synthetic oil used in many refrigeration systems including those with HFC-410A refrigerant. POE oil, if it ever comes in contact with PVC or CPVC piping, may cause failure of the PVC/CPVC. PVC/CPVC piping should never be used as supply or return water piping with water source heat pump products containing HFC-410A as system failures and property damage may result.

Water quantity should be plentiful and of good quality. Consult table 3 for water quality guidelines. The unit can be ordered with either a copper or cupro-nickel water heat exchanger. Consult Table 3 for recommendations. Copper is recommended for closed loop systems and open loop ground water systems that are not high in mineral content or corrosiveness. In conditions anticipating heavy scale formation or in brackish water, a cupro-nickel heat exchanger is recommended. In ground water situations where scaling could be heavy or where biological growth such as iron bacteria will be present, an open loop system is not recommended. Heat exchanger coils may over time lose heat exchange capabilities due to build up of mineral deposits. Heat exchangers must only be serviced by a qualified technician, as acid and special pumping equipment is required. Desuperheater coils can likewise become scaled and possibly plugged. In areas with extremely hard water, the owner should be informed that the heat exchanger may require occasional acid flushing. In some cases, the desuperheater option should not be recommended due to hard water conditions and additional maintenance required.

Water Quality Standards - Table 3 should be consulted for water quality requirements. Scaling potential should be assessed using the pH/Calcium hardness method. If the pH <7.5 and the calcium hardness is less than 100 ppm, scaling potential is low. If this method yields numbers out of range of those listed, the Ryznar Stability and Langelier Saturation indecies should be calculated. Use the appropriate scaling surface temperature for the application, 150°F [66°C] for direct use (well water/open loop) and DHW (desuperheater); 90°F [32°F] for indirect use. A monitoring plan should be implemented in these probable scaling situations. Other water quality issues such as iron fouling, corrosion prevention and erosion and clogging should be referenced in Table 3.

Expansion Tank and Pump - Use a closed, bladder-type expansion tank to minimize mineral formation due to air exposure. The expansion tank should be sized to provide at least one minute continuous run time of the pump using its drawdown capacity rating to prevent pump short cycling. Discharge water from the unit is not contaminated in any manner and can be disposed of in various ways, depending on local building codes (e.g. recharge well, storm sewer, drain field, adjacent stream or pond, etc.). Most local codes forbid the use of sanitary sewer for disposal. Consult your local building and zoning department to assure compliance in your area.

Water Control Valve - Note the placement of the water control valve in Figure 14. Always maintain water pressure in the heat exchanger by placing the water control valve(s) on the discharge line to prevent mineral precipitation during the off-cycle. Pilot operated slow closing valves are recommended to reduce water hammer. If water hammer persists, a mini-expansion tank can be mounted on the piping to help absorb the excess hammer shock. Ensure that the total 'VA' draw of the valve can be supplied by the unit transformer. For instance, a slow closing valve can draw up to 35VA. This can overload smaller 40 or 50 VA transformers depending on the other controls in the circuit. A typical pilot operated solenoid valve draws approximately 15VA (see Figure 19). Note the special wiring diagrams for slow closing valves (Figures 20 & 21).

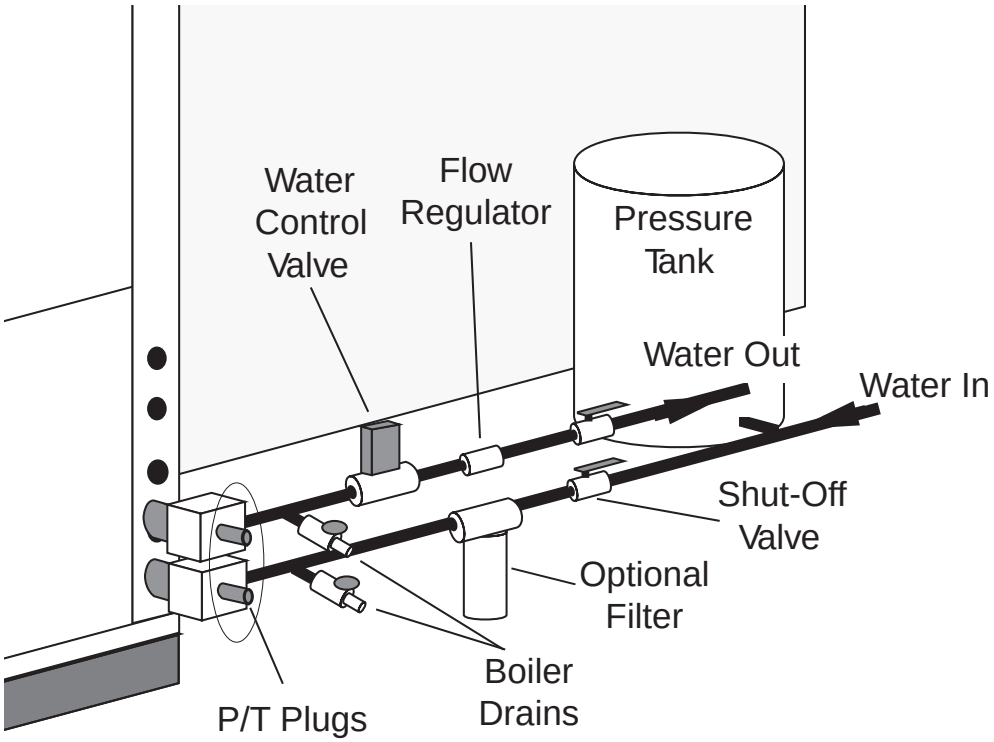
Ground-Water Heat Pump Applications

Flow Regulation - Flow regulation can be accomplished by two methods. One method of flow regulation involves simply adjusting the ball valve or water control valve on the discharge line. Measure the pressure drop through the unit heat exchanger, and determine flow rate from Table 9. Since the pressure is constantly varying, two pressure gauges may be needed. Adjust the valve until the desired flow of 1.5 to 2 gpm per ton [2.0 to 2.6 l/m per kW] is achieved. A second method of flow control requires a flow control device mounted on the outlet of the water control valve. The device is typically a brass fitting with an orifice of rubber or plastic material that is designed to allow a specified flow rate. On occasion, flow control devices may produce velocity noise that can be reduced by applying some back pressure from the ball valve located on the discharge line. Slightly closing the valve will spread the pressure drop over both devices, lessening the velocity noise.

Note: When EWT is below 50°F [10°C], 2 gpm per ton (2.6 l/m per kW) is required.

Water Coil Low Temperature Limit Setting - For all open loop systems the 30°F [-1.1°C] LT1 setting (factory setting-water) should be used to avoid freeze damage to the unit. See "Low Water Temperature Cutout Selection" in this manual for details on the low limit setting.

Figure 14: Typical Open Loop/Well Application



Water Quality Standards

Table 3: Water Quality Standards

Water Quality Parameter	HX Material	Closed Recirculating	Open Loop and Recirculating Well		
Scaling Potential - Primary Measurement					
Above the given limits, scaling is likely to occur. Scaling indexes should be calculated using the limits below					
pH/Calcium Hardness Method	All	-	**pH < 7.5 and Ca Hardness <100ppm**		
Index Limits for Probable Scaling Situations - (Operation outside these limits is not recommended)					
Scaling indexes should be calculated at 66°C for direct use and HWG applications, and at 32°C for indirect HX use. A monitoring plan should be implemented.					
Ryznar Stability Index	All	-	**6.0 - 7.5** If >7.5 minimize steel pipe use.		
Langelier Saturation Index	All	-	**-0.5 to +0.5** If <-0.5 minimize steel pipe use. Based upon 66°C HWG and Direct well, 29°C Indirect Well HX		
Iron Fouling					
Iron Fe $^{2+}$ (Ferrous) (Bacterial Iron potential)	All	-	**<0.2 ppm (Ferrous)** If Fe^{2+} (ferrous)>0.2 ppm with pH 6 - 8, O2<5 ppm check for iron bacteria.		
Iron Fouling	All	-	**<0.5 ppm of Oxygen** Above this level deposition will occur.		
Corrosion Prevention					
pH	All	**6 - 8.5** Monitor/treat as needed	**6 - 8.5** Minimize steel pipe below 7 and no open tanks with pH <8		
Hydrogen Sulfide (H_2S)	All	-	**<0.5 ppm** At H_2S>0.2 ppm, avoid use of copper and copper nickel piping or HX's. Rotten egg smell appears at 0.5 ppm level. Copper alloy (bronze or brass) cast components are OK to <0.5 ppm.		
Ammonia ion as hydroxide, chloride, nitrate and sulfate compounds	All	-	**<0.5 ppm**		
Maximum Chloride Levels			Maximum Allowable at maximum water temperature.		
			10°C	24°C	38°C
	Copper	-	<20ppm	NR	NR
	Cupronickel	-	<150 ppm	NR	NR
	304 SS	-	<400 ppm	<250 ppm	<150 ppm
	316 SS	-	<1000 ppm	<550 ppm	< 375 ppm
	Titanium	-	>1000 ppm	>550 ppm	>375 ppm
Erosion and Clogging					
Particulate Size and Erosion	All	<10 ppm of particles and a maximum velocity of 1.8 m/s Filtered for maximum 841 micron [0.84 mm, 20 mesh] size.	<10 ppm (<1 ppm "sandfree" for reinjection) of particles and a maximum velocity of 1.8 m/s. Filtered for maximum 841 micron 0.84 mm, 20 mesh] size. Any particulate that is not removed can potentially clog components.		

Rev.: 3/22/2012

The ClimateMaster Water Quality Table provides water quality requirements for ClimateMaster coaxial heat exchangers. When water properties are outside of those requirements, an external secondary heat exchanger must be used to isolate the heat pump heat exchanger from the unsuitable water. Failure to do so will void the warranty for the coaxial heat exchanger and any other components damaged by a leak.

Notes:
- Closed Recirculating system is identified by a closed pressurized piping system.
- Recirculating open wells should observe the open recirculating design considerations.
- NR - Application not recommended.
- "-" No design Maximum.

Electrical - Line Voltage

Electrical - Line Voltage - All field installed wiring, including electrical ground, must comply with the National Electrical Code as well as all applicable local codes. Refer to the unit electrical data for fuse sizes. Consult wiring diagram for field connections that must be made by the installing (or electrical) contractor. All final electrical connections must be made with a length of flexible conduit to minimize vibration and sound transmission to the building.

General Line Voltage Wiring - Be sure the available power is the same voltage and phase shown on the unit serial plate. Line and low voltage wiring must be done in accordance with local codes or the National Electric Code, whichever is applicable.

Transformer - All 208/230 voltage units are factory wired for 208 volt. If supply voltage is 230 volt, installer must rewire transformer. See wire diagram for connections.

⚠ WARNING! ⚠

WARNING! To avoid possible injury or death due to electrical shock, open the power supply disconnect switch and secure it in an open position during installation.

⚠ CAUTION! ⚠

CAUTION! Use only copper conductors for field installed electrical wiring. Unit terminals are not designed to accept other types of conductors.

Table 4a: Tranquility® 20 (TS) Series Electrical Data - (PSC Motor & ClimaDry®)

All TS Units with Standard PSC Motor								TS Units (PSC)			TS Units with PSC Fan Motor and ClimaDry®			
Model	Voltage Code	Rated Voltage	Voltage Min/Max	Compressor			Fan Motor FLA	Total Unit FLA	Min Circuit Amp	Max Fuse/ HACR	Reheat Pump FLA	Total Unit FLA	Min Circuit Amp	Max Fuse/ HACR
				QTY	RLA	LRA								
018	G	208-230/60/1	197/254	1	9.0	48.0	1.0	10.0	12.3	20	0.8	10.8	13.1	20
	E	265/60/1	239/292	1	8.4	40.0	0.9	9.3	11.4	15	0.7	10.0	12.1	20
024	G	208-230/60/1	197/254	1	13.5	58.3	1.6	15.1	18.5	30	0.8	15.9	19.3	30
	E	265/60/1	239/292	1	9	54.0	1.1	10.1	12.4	20	0.7	10.8	13.1	20
	H	208-230/60/3	197/254	1	7.1	55.4	1.6	8.7	10.5	15	0.8	9.5	11.3	15
	F*	460/60/3*	414/506	1	3.5	28.0	0.9	4.4	5.3	15	0.7	5.1	6.0	15
030	G	208-230/60/1	197/254	1	12.8	64.0	1.8	14.6	17.8	30	0.8	15.4	18.6	30
	E	265/60/1	239/292	1	10.9	60.0	1.4	12.3	15.0	25	0.7	13.0	15.7	25
	H	208-230/60/3	197/254	1	8.3	58.0	1.8	10.1	12.2	20	0.8	10.9	13.0	20
	F*	460/60/3*	414/506	1	5.1	28.0	1.0	6.1	7.4	15	0.7	6.8	8.1	15
036	G	208-230/60/1	197/254	1	16.0	77.0	1.8	17.8	21.8	35	0.8	18.6	22.6	35
	H	208-230/60/3	197/254	1	10	71.0	1.8	11.8	14.3	20	0.8	12.6	15.1	25
	F*	460/60/3*	414/506	1	4.7	38.0	1.0	5.7	6.9	15	0.7	6.4	7.6	15
042	G	208-230/60/1	197/254	1	16.7	79.0	2.2	18.9	23.1	35	0.8	19.7	23.9	40
	E	265/60/1	239/292	1	13.5	72.0	1.7	15.2	18.6	30	0.7	15.9	19.3	30
	H	208-230/60/3	197/254	1	10.4	73.0	2.2	12.6	15.2	25	0.8	13.4	16.0	25
	F*	460/60/3*	414/506	1	5.8	38.0	1.0	6.8	8.3	15	0.7	7.5	9.0	15
	N	575/60/3	518/633	1	3.8	36.5	0.8	4.6	5.6	15	N/A	N/A	N/A	N/A
048	G	208-230/60/1	197/254	1	21.8	117.0	2.7	24.5	30.0	50	1.1	25.6	31.0	50
	E	265/60/1	239/292	1	16.3	98.0	2.9	19.2	23.3	35	1.3	20.5	24.6	40
	H	208-230/60/3	197/254	1	13.7	83.1	2.7	16.4	19.8	30	1.1	17.5	20.9	30
	F*	460/60/3*	414/506	1	6.2	41.0	1.7	7.9	9.5	15	1.3	9.0	10.6	15
	N	575/60/3	518/633	1	4.8	33.0	1.4	6.2	7.4	15	N/A	N/A	N/A	N/A
060	G	208-230/60/1	197/254	1	26.4	134.0	3.8	30.2	36.8	60	1.1	31.3	37.9	60
	H	208-230/60/3	197/254	1	16	110.0	3.8	19.8	23.8	35	1.1	20.9	24.9	40
	F*	460/60/3*	414/506	1	7.8	52.0	1.3	9.1	11.1	15	1.3	10.4	12.4	20
	N	575/60/3	518/633	1	5.7	38.9	2.2	7.9	9.3	15	N/A	N/A	N/A	N/A
070	G	208-230/60/1	197/254	1	30.8	178.0	4.0	34.8	42.5	70	1.1	35.9	43.6	70
	H	208-230/60/3	197/254	1	19.6	138.0	4.0	23.6	28.5	45	1.1	24.7	29.6	45
	F*	460/60/3*	414/506	1	8.2	66.1	2.6	10.8	12.9	20	1.3	12.1	14.2	20
	N	575/60/3	518/633	1	6.6	55.3	1.5	8.1	9.8	15	N/A	N/A	N/A	N/A

* NEUTRAL CONNECTION REQUIRED! All F Voltage (460 vac) units with ClimaDry® require a four wire power supply with neutral.
Reheat pump is rated 265 vac and is wired between one hot leg and neutral.

Electrical - Line Voltage

Table 4b: Tranquility® 20 (TS) Series Electrical Data - (PSC High Static Motor & ClimaDry®)

All TS Units with High Static PSC Fan Motor								TS (H.S. PSC) Units			TS Units with H.S. PSC Fan Motor and ClimaDry®			
Model	Voltage Code	Rated Voltage	Voltage Min/Max	Compressor			Fan Motor FLA	Total Unit FLA	Min Circuit Amp	Max Fuse/ HACR	Reheat Pump FLA	Total Unit FLA	Min Circuit Amp	Max Fuse/ HACR
				QTY	RLA	LRA								
018	G	208-230/60/1	197/254	1	9.0	48.0	1.1	10.1	12.4	20	0.8	10.9	13.2	20
	E	265/60/1	239/292	1	8.4	40.0	0.9	9.3	11.4	15	0.7	10.0	12.1	20
024	G	208-230/60/1	197/254	1	13.5	58.3	1.8	15.3	18.7	30	0.8	16.1	19.5	30
	E	265/60/1	239/292	1	9	54.0	1.4	10.4	12.7	20	0.7	11.1	13.4	20
	H	208-230/60/3	197/254	1	7.1	55.4	1.8	8.9	10.7	15	0.8	9.7	11.5	15
	F*	460/60/3*	414/506	1	3.5	28.0	1	4.5	5.4	15	0.7	5.2	6.1	15
030	G	208-230/60/1	197/254	1	12.8	64.0	2.2	15.0	18.2	30	0.8	15.8	19.0	30
	E	265/60/1	239/292	1	10.9	60.0	1.7	12.6	15.3	25	0.7	13.3	16.0	25
	H	208-230/60/3	197/254	1	8.3	58.0	2.2	10.5	12.6	20	0.8	11.3	13.4	20
	F*	460/60/3*	414/506	1	5.1	28.0	1.0	6.1	7.4	15	0.7	6.8	8.1	15
036	G	208-230/60/1	197/254	1	16.0	77.0	2.2	18.2	22.2	35	0.8	19.0	23.0	35
	H	208-230/60/3	197/254	1	10	71.0	2.2	12.2	14.7	25	0.8	13.0	15.5	25
	F*	460/60/3*	414/506	1	4.7	38.0	1.0	5.7	6.9	15	0.7	6.4	7.6	15
042	G	208-230/60/1	197/254	1	16.7	79.0	2.7	19.4	23.6	35	0.8	20.2	24.4	40
	E	265/60/1	239/292	1	13.5	72.0	2.9	16.4	19.8	30	0.7	17.1	20.5	30
	H	208-230/60/3	197/254	1	10.4	73.0	2.7	13.1	15.7	25	0.8	13.9	16.5	25
	F*	460/60/3*	414/506	1	5.8	38.0	1.7	7.5	9.0	15	0.7	8.2	9.7	15
	N	575/60/3	518/633	1	3.8	36.5	1.4	5.2	6.2	15	N/A	N/A	N/A	N/A
048	G	208-230/60/1	197/254	1	21.8	117.0	2.6	24.4	29.9	50	1.1	25.5	31.0	50
	H	208-230/60/3	197/254	1	13.7	83.1	2.6	16.3	19.7	30	1.1	17.4	20.8	30
	F*	460/60/3*	414/506	1	6.2	41.0	1.8	8.0	9.6	15	1.3	9.3	10.9	15
	N	575/60/3	518/633	1	4.8	33.0	1.4	6.2	7.4	15	N/A	N/A	N/A	N/A
060	G	208-230/60/1	197/254	1	26.4	134.0	4.0	30.4	37.0	60	1.1	31.5	38.1	60
	H	208-230/60/3	197/254	1	16	110.0	4.0	20.0	24.0	35	1.1	21.1	25.1	40
	F*	460/60/3*	414/506	1	7.8	52.0	2.6	10.4	12.4	15	1.3	11.7	13.7	20
	N	575/60/3	518/633	1	5.7	38.9	1.5	7.2	8.6	15	N/A	N/A	N/A	N/A

* NEUTRAL CONNECTION REQUIRED! All F Voltage (460 vac) units with ClimaDry® require a four wire power supply with neutral.
Reheat pump is rated 265 vac and is wired between one hot leg and neutral.

Tranquility® 20 (TS) Series
Rev.:02/05/14

Electrical - Line Voltage

Table 4c: Tranquility® 20 (TS) Series Electrical Data - (ECM Motor & ClimaDry®)

All TS Units with ECM Fan Motor								TS Units (ECM)			TS Units with ECM Fan Motor and ClimaDry®			
Model	Voltage Code	Rated Voltage	Voltage Min/Max	Compressor			Fan Motor FLA	Total Unit FLA	Min Circuit Amp	Max Fuse/ HACR	Reheat Pump FLA	Total Unit FLA	Min Circuit Amp	Max Fuse/ HACR
				QTY	RLA	LRA								
018	G	208-230/60/1	197/254	1	9.0	48.0	3.9	12.9	15.2	20	0.8	13.7	16.0	20
	E	265/60/1	239/292	1	8.4	40.0	3.2	11.6	13.7	20	0.7	12.3	14.4	20
024	G	208-230/60/1	197/254	1	13.5	58.3	3.9	17.4	20.8	30	0.8	18.2	21.6	35
	E	265/60/1	239/292	1	9	54.0	3.2	12.2	14.5	20	0.7	12.9	15.2	20
	H	208-230/60/3	197/254	1	7.1	55.4	3.9	11.0	12.8	15	0.8	11.8	13.6	20
	F*	460/60/3*	414/506	1	3.5	28.0	3.2	6.7	7.6	15	0.7	7.4	8.3	15
030	G	208-230/60/1	197/254	1	12.8	64.0	3.9	16.7	19.9	30	0.8	17.5	20.7	30
	E	265/60/1	239/292	1	10.9	60.0	3.2	14.1	16.8	25	0.7	14.8	17.5	25
	H	208-230/60/3	197/254	1	8.3	58.0	3.9	12.2	14.3	20	0.8	13.0	15.1	20
	F*	460/60/3*	414/506	1	5.1	28.0	3.2	8.3	9.6	15	0.7	9.0	10.3	15
036	G	208-230/60/1	197/254	1	16.0	77.0	3.9	19.9	23.9	35	0.8	20.7	24.7	40
	H	208-230/60/3	197/254	1	10	71.0	3.9	13.9	16.4	25	0.8	14.7	17.2	25
	F*	460/60/3*	414/506	1	4.7	38.0	3.2	7.9	9.1	15	0.7	8.6	9.8	15
042	G	208-230/60/1	197/254	1	16.7	79.	3.9	20.6	24.8	40	0.8	21.4	25.6	40
	E	265/60/1	239/292	1	13.5	72.0	3.2	16.7	20.1	30	0.7	17.4	20.8	30
	H	208-230/60/3	197/254	1	10.4	73.0	3.9	14.3	16.9	25	0.8	15.1	17.7	25
	F*	460/60/3*	414/506	1	5.8	38.0	3.2	9.0	10.5	15	0.7	9.7	11.2	15
048	G	208-230/60/1	197/254	1	21.8	117.0	6.9	28.7	34.2	50	1.1	29.8	35.3	50
	E	265/60/1	239/292	1	16.3	98.0	6.0	22.3	26.4	40	1.3	23.6	27.7	40
	H	208-230/60/3	197/254	1	13.7	83.1	6.9	20.6	24.0	35	1.1	21.7	25.1	35
	F*	460/60/3*	414/506	1	6.2	41.0	6.0	12.2	13.8	20	1.3	13.5	15.1	20
060	G	208-230/60/1	197/254	1	26.4	134.0	6.9	33.3	39.9	60	1.1	34.4	41.0	60
	E	265/60/1	239/292	1	19.9	130.0	6.0	25.9	30.9	50	N/A	N/A	N/A	N/A
	H	208-230/60/3	197/254	1	16	110.0	6.9	22.9	26.9	40	1.1	24.0	28.0	40
	F*	460/60/3*	414/506	1	7.8	52.0	6.0	13.8	15.8	20	1.3	15.1	17.1	20
070	G	208-230/60/1	197/254	1	30.8	178.0	6.9	37.7	45.4	70	1.1	37.9	45.6	70
	H	208-230/60/3	197/254	1	19.6	138.0	6.9	26.5	31.4	50	1.1	27.6	32.5	50
	F*	460/60/3*	414/506	1	8.2	66.1	6.0	14.2	16.3	20	1.3	15.5	17.6	25

* NEUTRAL CONNECTION REQUIRED! All F Voltage (460 vac) units with ECM motors/ClimaDry® require a four wire power supply with neutral.
ECM motors/reheat pumps are rated 265 vac and are wired between one hot leg and neutral.

Electrical - Line Voltage

Table 4d: Tranquility® 20 (TS) Series Electrical Data - (PSC Motor & Secondary Pump)

All TS Units with Standard PSC Motor								TS Units (PSC)			TS Units with PSC Fan Motor and Secondary Pump			
Model	Voltage Code	Rated Voltage	Voltage Min/ Max	Compressor			Fan Motor FLA	Total Unit FLA	Min Circuit Amp	Max Fuse/ HACR	Pump FLA	Total Unit FLA	Min Circuit Amp	Max Fuse/ HACR
				QTY	RLA	LRA								
006	G	208-230/60/1	197/254	1	3.1	17.7	0.4	3.5	4.3	15	0.4	3.9	4.7	15
	E	265/60/1	239/292	1	2.6	13.5	0.4	3.0	3.6	15	0.7	3.7	4.3	15
009	G	208-230/60/1	197/254	1	3.9	21.0	0.4	4.3	5.3	15	0.4	4.7	5.7	15
	E	265/60/1	239/292	1	3.7	22.0	0.4	4.1	5.0	15	0.7	4.8	5.7	15
012	G	208-230/60/1	197/254	1	5.0	25.0	0.7	5.7	7.0	15	0.4	6.1	7.4	15
	E	265/60/1	239/292	1	4.5	22.0	0.7	5.2	6.4	15	0.7	5.9	7.0	15
018	G	208-230/60/1	197/254	1	9.0	48.0	1.0	10.0	12.3	20	0.4	10.4	12.7	20
	E	265/60/1	239/292	1	8.4	40.0	0.9	9.3	11.4	15	0.7	10.0	12.1	20
024	G	208-230/60/1	197/254	1	13.5	58.3	1.6	15.1	18.5	30	0.4	15.5	18.9	30
	E	265/60/1	239/292	1	9	54.0	1.1	10.1	12.4	20	0.7	10.8	13.1	20
	H	208-230/60/3	197/254	1	7.1	55.4	1.6	8.7	10.5	15	0.4	9.13	10.9	15
	F*	460/60/3*	414/506	1	3.5	28.0	0.9	4.4	5.3	15	0.7	5.1	6.0	15
030	G	208-230/60/1	197/254	1	12.8	64.0	1.8	14.6	17.8	30	0.8	15.4	18.6	30
	E	265/60/1	239/292	1	10.9	60.0	1.4	12.3	15.0	25	0.7	13.0	15.7	25
	H	208-230/60/3	197/254	1	8.3	58.0	1.8	10.1	12.2	20	0.8	10.9	13.0	20
	F*	460/60/3*	414/506	1	5.1	28.0	1.0	6.1	7.4	15	6.8	8.1	7.2	15
036	G	208-230/60/1	197/254	1	16.0	77.0	1.8	17.8	21.8	35	0.8	18.6	22.6	35
	H	208-230/60/3	197/254	1	10	71.0	1.8	11.8	14.3	20	0.8	12.6	15.1	25
	F*	460/60/3*	414/506	1	4.7	38.0	1.0	5.7	6.9	15	0.7	6.4	7.6	15
042	G	208-230/60/1	197/254	1	16.7	79.0	2.2	18.9	23.1	35	0.8	19.7	23.9	40
	E	265/60/1	239/292	1	13.5	72.0	1.7	15.2	18.6	30	0.7	15.9	19.3	30
	H	208-230/60/3	197/254	1	10.4	73.0	2.2	12.6	15.2	25	0.8	13.4	16.0	25
	F*	460/60/3*	414/506	1	5.8	38.0	1.0	6.8	8.3	15	0.7	7.5	9.0	15
	N	575/60/3	518/633	1	3.8	36.5	0.8	4.6	5.6	15	N/A	N/A	N/A	N/A
048	G	208-230/60/1	197/254	1	21.8	117.0	2.7	24.5	30.0	50	0.8	25.3	30.8	50
	E	265/60/1	239/292	1	16.3	98.0	2.9	19.2	23.3	35	0.7	19.9	24.0	40
	H	208-230/60/3	197/254	1	13.7	83.1	2.7	16.4	19.8	30	0.8	17.2	20.6	30
	F*	460/60/3*	414/506	1	6.2	41.0	1.7	7.9	9.5	15	0.7	8.6	10.2	15
	N	575/60/3	518/633	1	4.8	33.0	1.4	6.2	7.4	15	N/A	N/A	N/A	N/A
060	G	208-230/60/1	197/254	1	26.4	134.0	3.8	30.2	36.8	60	1.1	31.3	37.9	60
	H	208-230/60/3	197/254	1	16	110.0	3.8	19.8	23.8	35	1.1	20.9	24.9	40
	F*	460/60/3*	414/506	1	7.8	52.0	1.3	9.1	11.1	15	1.3	10.4	12.4	20
	N	575/60/3	518/633	1	5.7	38.9	2.2	7.9	9.3	15	N/A	N/A	N/A	N/A
070	G	208-230/60/1	197/254	1	30.8	178.0	4.0	34.8	42.5	70	1.1	35.9	43.6	70
	H	208-230/60/3	197/254	1	19.6	138.0	4.0	23.6	28.5	45	1.1	24.7	29.6	45
	F*	460/60/3*	414/506	1	8.2	66.1	2.6	10.8	12.9	20	1.3	12.1	14.2	20
	N	575/60/3	518/633	1	6.6	55.3	1.5	8.1	9.8	15	N/A	N/A	N/A	N/A

* NEUTRAL CONNECTION REQUIRED! All F Voltage (460 vac) units with internal secondary circulators require a four wire power supply with neutral. Internal secondary circulators are rated 265 vac and are wired between one hot leg and neutral.

Tranquility® 20 (TS) Series
Rev.:02/05/14

Electrical - Line Voltage

Table 4e: Tranquility® 20 (TS) Series Electrical Data - (PSC High Static Motor & Secondary Pump)

All TS Units with High Static PSC Fan Motor								TS (H.S. PSC) Units			TS Units with H.S. PSC Fan Motor and Secondary Pump			
Model	Voltage Code	Rated Voltage	Voltage Min/ Max	Compressor			Fan Motor FLA	Total Unit FLA	Min Circuit Amp	Max Fuse/ HACR	Pump FLA	Total Unit FLA	Min Circuit Amp	Max Fuse/ HACR
				QTY	RLA	LRA								
018	G	208-230/60/1	197/254	1	9.0	48.0	1.1	10.1	12.4	20	0.4	10.5	12.8	20
	E	265/60/1	239/292	1	8.4	40.0	0.9	9.3	11.4	15	0.7	10.0	12.1	20
024	G	208-230/60/1	197/254	1	13.5	58.3	1.8	15.3	18.7	30	0.4	15.7	19.1	30
	E	265/60/1	239/262	1	9	54.0	1.4	10.4	12.7	20	0.7	11.1	13.4	20
	H	208-230/60/3	197/254	1	7.1	55.4	1.8	8.9	10.7	15	0.4	9.3	11.1	15
	F*	460/60/3*	414/506	1	3.5	28.0	1	4.5	5.4	15	0.7	5.2	6.1	15
030	G	208-230/60/1	197/254	1	12.8	64.0	2.2	15.0	18.2	30	0.8	15.8	19.0	30
	E	265/60/1	239/292	1	10.9	60.0	1.7	12.6	15.3	25	0.7	13.3	16.0	25
	H	208-230/60/3	197/254	1	8.3	58.0	2.2	10.5	12.6	20	0.8	11.3	13.4	20
	F*	460/60/3*	414/506	1	5.1	28.0	1.0	6.1	7.4	15	0.7	6.8	8.1	15
036	G	208-230/60/1	197/254	1	16.0	77.0	2.2	18.2	22.2	35	0.8	19.0	23.0	35
	H	208-230/60/3	197/254	1	10	71.0	2.2	12.2	14.7	25	0.8	13.0	15.5	25
	F*	460/60/3*	414/506	1	4.7	38.0	1.0	5.7	6.9	15	0.7	6.4	7.6	15
042	G	208-230/60/1	197/254	1	16.7	79.0	2.7	19.4	23.6	35	0.8	20.2	24.4	40
	E	265/60/1	239/292	1	13.5	72.0	2.9	16.4	19.8	30	0.7	17.1	20.5	30
	H	208-230/60/3	197/254	1	10.4	73.0	2.7	13.1	15.7	25	0.8	13.9	16.5	25
	F*	460/60/3*	414/506	1	5.8	38.0	1.7	7.5	9.0	15	0.7	8.2	9.7	15
	N	575/60/3	518/633	1	3.8	36.5	1.4	5.2	6.2	15	N/A	N/A	N/A	N/A
048	G	208-230/60/1	197/254	1	21.8	117.0	2.6	24.4	29.9	50	0.8	25.2	30.7	50
	H	208-230/60/3	197/254	1	13.7	83.1	2.6	16.3	19.7	30	0.8	17.1	20.5	30
	F*	460/60/3*	414/506	1	6.2	41.0	1.8	8.0	9.6	15	0.7	8.7	10.3	15
	N	575/60/3	518/633	1	4.8	33.0	1.4	6.2	7.4	15	N/A	N/A	N/A	N/A
060	G	208-230/60/1	197/254	1	26.4	134.0	4.0	30.4	37.0	60	1.1	31.5	38.1	60
	H	208-230/60/3	197/254	1	16	110.0	4.0	20.0	24.0	35	1.1	21.1	25.1	40
	F*	460/60/3*	414/506	1	7.8	52.0	2.6	10.4	12.4	15	1.3	11.7	13.7	20
	N	575/60/3	518/633	1	5.7	38.9	1.5	7.2	8.6	15	N/A	N/A	N/A	N/A

* NEUTRAL CONNECTION REQUIRED! All F Voltage (460 vac) units with internal secondary circulators require a four wire power supply with neutral. Internal secondary circulators are rated 265 vac and are wired between one hot leg and neutral.

Electrical - Line Voltage

Table 4f: Tranquility® 20 (TS) Series Electrical Data - (ECM Motor & Secondary Pump)

All TS Units with ECM Fan Motor								TS Units (ECM)			TS Units with ECM Fan Motor and Secondary Pump			
Model	Voltage Code	Rated Voltage	Voltage Min/Max	Compressor			Fan Motor FLA	Total Unit FLA	Min Circuit Amp	Max Fuse/ HACR	Pump FLA	Total Unit FLA	Min Circuit Amp	Max Fuse/ HACR
				QTY	RLA	LRA								
018	G	208-230/60/1	197/254	1	9.0	48.0	3.9	12.9	15.2	20	0.4	13.3	15.6	20
	E	265/60/1	239/292	1	8.4	40.0	3.2	11.6	13.7	20	0.7	12.3	14.4	20
024	G	208-230/60/1	197/254	1	13.5	58.3	3.9	17.4	20.8	30	0.4	17.8	21.2	30
	E	265/60/1	239/292	1	9	54.0	3.2	12.2	14.5	20	0.7	12.9	15.2	20
	H	208-230/60/3	197/254	1	7.1	55.4	3.9	11.0	12.8	15	0.4	11.4	13.2	20
	F*	460/60/3*	414/506	1	3.5	28.0	3.2	6.7	7.6	15	0.7	7.4	8.3	15
030	G	208-230/60/1	197/254	1	12.8	64.0	3.9	16.7	19.9	30	0.8	17.5	20.7	30
	E	265/60/1	239/292	1	10.9	60.0	3.2	14.1	16.8	25	0.7	14.8	17.5	25
	H	208-230/60/3	197/254	1	8.3	58.0	3.9	12.2	14.3	20	0.8	13.0	15.1	20
	F*	460/60/3*	414/506	1	5.1	28.0	3.2	8.3	9.6	15	0.7	9.0	10.3	15
036	G	208-230/60/1	197/254	1	16.0	77.0	3.9	19.9	23.9	35	0.8	20.7	24.7	40
	H	208-230/60/3	197/254	1	10	71.0	3.9	13.9	16.4	25	0.8	14.7	17.2	25
	F*	460/60/3*	414/506	1	4.7	38.0	3.2	7.9	9.1	15	0.7	8.6	9.8	15
042	G	208-230/60/1	197/254	1	16.7	79.0	3.9	20.6	24.8	40	0.8	21.4	25.6	40
	E	265/60/1	239/292	1	13.5	72.0	3.2	16.7	20.1	30	0.7	17.4	20.8	30
	H	208-230/60/3	197/254	1	10.4	73.0	3.9	14.3	16.9	25	0.8	15.1	17.7	25
	F*	460/60/3*	414/506	1	5.8	38.0	3.2	9.0	10.5	15	0.7	9.7	11.2	15
048	G	208-230/60/1	197/254	1	21.8	117.0	6.9	28.7	34.2	50	0.8	29.5	35.0	50
	E	265/60/1	239/292	1	16.3	98.0	6.0	22.3	26.4	40	0.7	23.	27.1	40
	H	208-230/60/3	197/254	1	13.7	83.1	6.9	20.6	24.0	35	0.8	21.4	24.8	35
	F*	460/60/3*	414/506	1	6.2	41.0	6.0	12.2	13.8	20	0.7	12.9	14.5	20
060	G	208-230/60/1	197/254	1	26.4	134.0	6.9	33.3	39.9	60	1.1	34.4	41.0	60
	E	265/60/1	239/292	1	19.9	130.0	6.0	25.9	30.9	50	N/A	N/A	N/A	N/A
	H	208-230/60/3	197/254	1	16	110.0	6.9	22.9	26.9	40	1.1	24.0	28.0	40
	F*	460/60/3*	414/506	1	7.8	52.0	6.0	13.8	15.8	20	1.3	15.1	17.1	20
070	G	208-230/60/1	197/254	1	30.8	178.0	6.9	37.7	45.4	70	1.1	37.9	45.6	70
	H	208-230/60/3	197/254	1	19.6	138.0	6.9	26.5	31.4	50	1.1	27.6	32.5	50
	F*	460/60/3*	414/506	1	8.2	66.1	6.0	14.2	16.3	20	1.3	15.5	17.6	25

* NEUTRAL CONNECTION REQUIRED! All F Voltage (460 vac) units with ECM motors/internal secondary circulators require a four wire power supply with neutral. ECM motors/internal secondary circulators are rated 265 vac and are wired between one hot leg and neutral.

Electrical - Power Wiring

⚠ WARNING! ⚠

WARNING! Disconnect electrical power source to prevent injury or death from electrical shock.

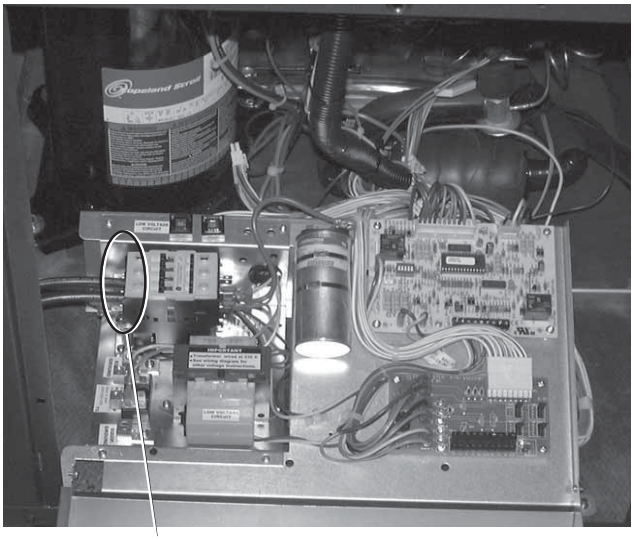
⚠ CAUTION! ⚠

CAUTION! Use only copper conductors for field installed electrical wiring. Unit terminals are not designed to accept other types of conductors.

Electrical - Line Voltage - All field installed wiring, including electrical ground, must comply with the National Electrical Code as well as all applicable local codes. Refer to the unit electrical data for fuse sizes. Consult wiring diagram for field connections that must be made by the installing (or electrical) contractor. All final electrical connections must be made with a length of flexible conduit to minimize vibration and sound transmission to the building.

General Line Voltage Wiring - Be sure the available power is the same voltage and phase shown on the unit serial plate. Line and low voltage wiring must be done in accordance with local codes or the National Electric Code, whichever is applicable.

Figure 15: Single Phase Line Voltage Field Wiring. Three phase wiring is similar except that all three power wires are directly connected to the contactor.



Unit Power Supply
(see electrical table for wire and breaker size)

Note: 460V units with ECM motor require a neutral wire.

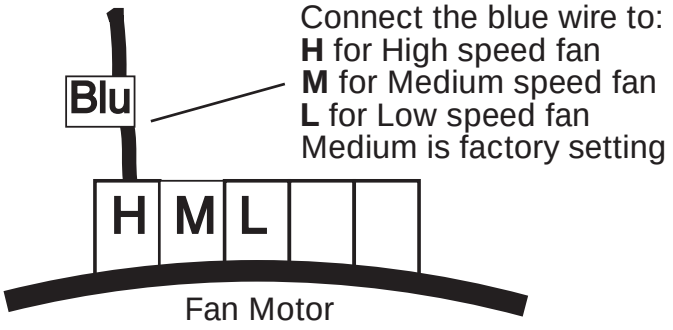
Power Connection - Line voltage connection is made by connecting the incoming line voltage wires to the "L" side of the contractor as shown in Figure 15 or to the optional service disconnect when provided. Consult electrical data tables for correct fuse size.

Transformer - All 208/230 voltage units are factory wired for 208 volt. If supply voltage is 230 volt, installer must rewire transformer. See wire diagram for connections.

Blower Speed Selection – Units with PSC Motor - PSC (Permanent Split Capacitor) blower fan speed can be changed by moving the blue wire on the fan motor terminal block to the desired speed as shown in Figure 16. Most ClimateMaster units are shipped on the medium speed tap. Consult submittal data or engineering design guide for specific unit airflow tables. Typical unit design delivers rated airflow at nominal static (0.15 in. w.g. [37Pa]) on medium speed and rated airflow at a higher static (0.4 to 0.5 in. w.g. [100 to 125 Pa]) on high speed for applications where higher static is required. Low speed will deliver approximately 85% of rated airflow at 0.10 in. w.g. [25 Pa]. An optional high static blower is available on some models.

Special Note for AHRI Testing: To achieve rated airflow for AHRI testing purposes on all PSC products, it is necessary to change the fan speed to "HI" speed. When the heat pump has experienced less than 100 operational hours and the coil has not had sufficient time to be "seasoned", it is necessary to clean the coil with a mild surfactant such as Calgon to remove the oils left by manufacturing processes and enable the condensate to properly "sheet" off of the coil.

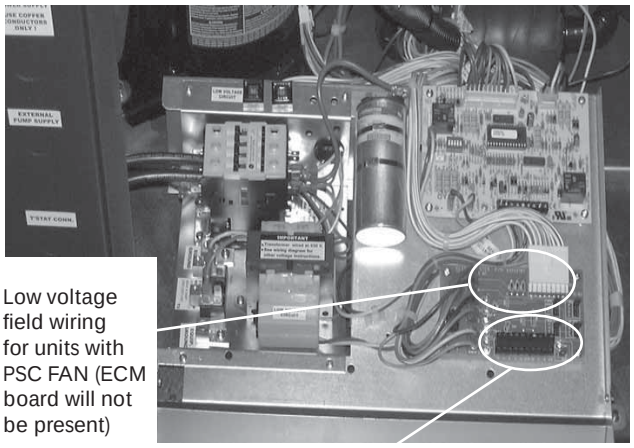
Figure 16: PSC Motor Speed Selection



Electrical - Power & Low Voltage Wiring

Thermostat Connections - The thermostat should be wired directly to the CXM or DXM board (units with PSC fan). Units with optional ECM motor include factory wiring from the CXM or DXM board to the ECM interface board. Thermostat wiring for these units should be connected to the ECM interface board. Figure 17 shows wiring for units with PSC or ECM motor. See "Electrical – Thermostat" for specific terminal connections. Review the appropriate AOM (Application, Operation and Maintenance) manual for units with DDC controls.

Figure 17: TT/TS Low Voltage Field Wiring



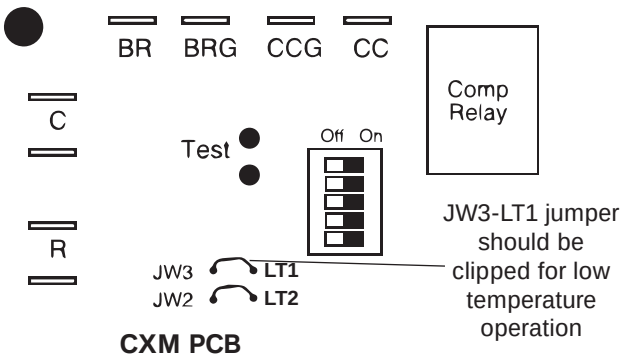
Low voltage field wiring for units with ECM fan

Low Water Temperature Cutout Selection - The CXM/DXM control allows the field selection of low water (or water-antifreeze solution) temperature limit by clipping jumper JW3, which changes the sensing temperature associated with thermistor LT1. Note that the LT1 thermistor is located on the refrigerant line between the coaxial heat exchanger and expansion device (TXV). Therefore, LT1 is sensing refrigerant temperature, not water temperature, which is a better indication of how water flow rate/temperature is affecting the refrigeration circuit.

The factory setting for LT1 is for systems using water (30°F [-1.1°C] refrigerant temperature). In low water temperature (extended range) applications with antifreeze (most ground loops), jumper JW3 should be clipped as shown in Figure 18 to change the setting to 10°F [-12.2°C] refrigerant temperature, a more suitable temperature when using an antifreeze solution. All ClimateMaster units operating with entering water temperatures below 60°F [15.6°C] must include the optional water/refrigerant circuit insulation package to prevent internal condensation.

Electrical - Low Voltage Wiring

Figure 18: LT1 Limit Setting



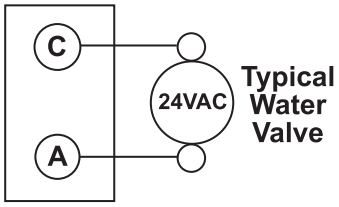
Accessory Connections
A terminal paralleling the compressor contactor coil has been provided on the CXM/DXM control. Terminal "A" is designed to control accessory devices, such as water valves. Note: This terminal should be used only with 24 Volt signals and not line voltage. Terminal "A" is energized with the compressor contactor. See Figure 19 or the specific unit wiring diagram for details.

Low Voltage VA Ratings

Component	VA
Typical Blower Relay	6 - 7
Typical Reversing Valve Solenoid	4 - 6
30A Compressor Contactor	6 - 9
Subtotal	**16 - 22**
+ CXM board (5 - 9 VA)*	21 - 31
Remaing VA for Accessories	19 - 29
+ DXM board (8 - 12 VA)*	24 - 34
Remaing VA for Accessories	41 - 51

*Standard transformer for CXM board is 50VA. Optional DXM board and/or DDC controls include 75VA transformer.

Figure 19: Accessory Wiring
Terminal Strip



Water Solenoid Valves - An external solenoid valve(s) should be used on ground water installations to shut off flow to the unit when the compressor is not operating. A slow closing valve may be required to help reduce water hammer. Figure 19 shows typical wiring for a 24VAC external solenoid valve. Figures 20 and 21 illustrate typical slow closing water control valve wiring for Taco 500 series (ClimateMaster P/N AVM) and Taco SBV series valves. Slow closing valves take approximately 60 seconds to open (very little water will flow before 45 seconds). Once fully open, an end switch allows the compressor to be energized. Only relay or triac based electronic thermostats should be used with slow closing valves. When wired as shown, the slow closing valve will operate properly with the following notations:

1. The valve will remain open during a unit lockout.
2. The valve will draw approximately 25-35 VA through the "Y" signal of the thermostat.

Note: This valve can overheat the anticipator of an electromechanical thermostat. Therefore, only relay or triac based thermostats should be used.

Figure 20: AVM Valve Wiring

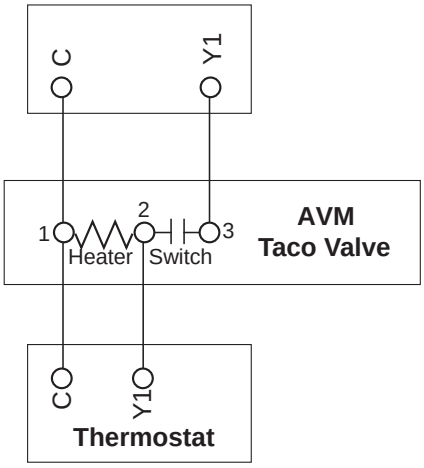
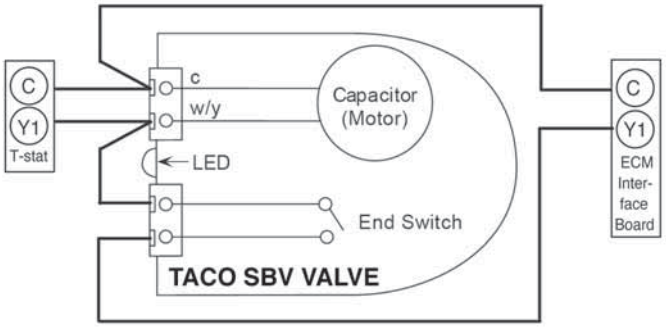


Figure 21: Taco SBV Valve Wiring



Electrical - Thermostat Wiring

Thermostat Installation - The thermostat should be located on an interior wall in a larger room, away from supply duct drafts. DO NOT locate the thermostat in areas subject to sunlight, drafts or on external walls. The wire access hole behind the thermostat may in certain cases need to be sealed to prevent erroneous temperature measurement. Position the thermostat back plate against the wall so that it appears level and so the thermostat wires protrude through the middle of the back plate. Mark the position of the back plate mounting holes and drill holes with a 3/16" (5mm) bit. Install supplied anchors and secure plate to the wall. Thermostat wire must be 18 AWG wire. Representative thermostat wiring is shown in Figures 22a-c however, actual wiring connections should be determined from the thermostat IOM and or unit wiring diagram. Practically any heat pump thermostat will work with ClimateMaster units, provided it has the correct number of heating and cooling stages.

Figure 22a: Units With PSC Fan

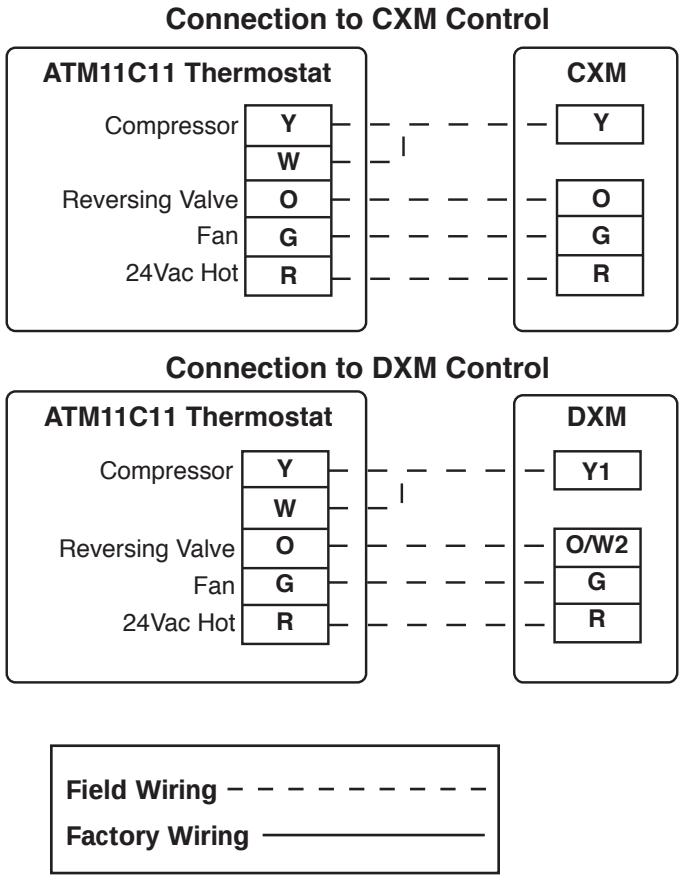


Figure 22b: Units With ECM Fan

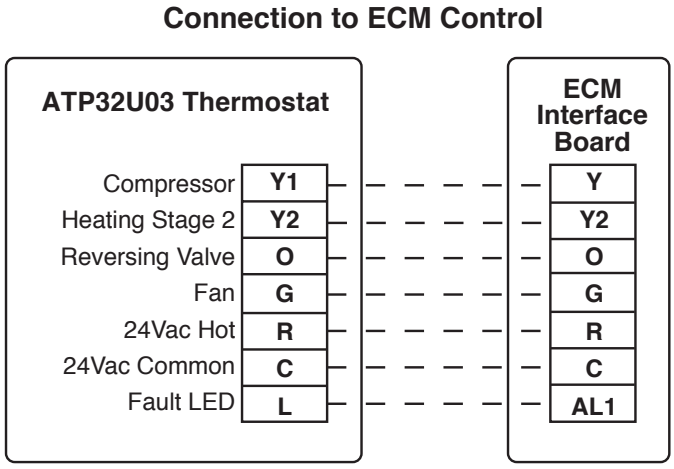
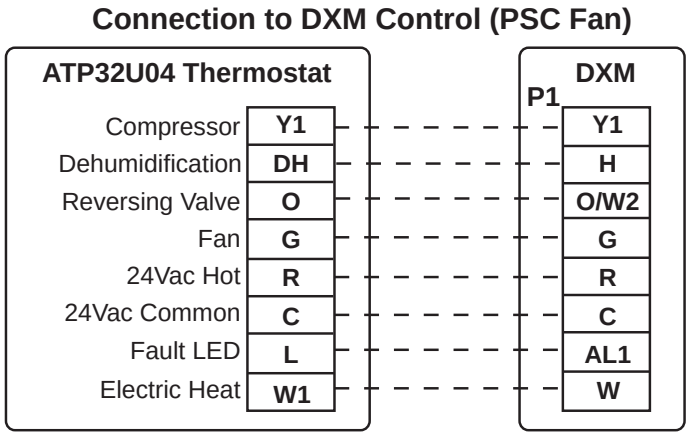


Figure 22c: Units with ClimaDry® Reheat



Single stage unit with ClimaDry Modulating Reheat Option and PSC fan

Tranquility® 20 (TS) Series
Rev.:02/05/14

TS Blower Performance Data - (ECM Motor) - Standard Unit - No Reheat

Airflow in CFM with wet coil and clean air filter

Model	Max ESP (in. wg)	Fan Motor (hp)	Tap Setting	Cooling Mode			Dehumid Mode			Heating Mode			Residential Units Only	
				Stg 1	Stg 2	Fan	Stg 1	Stg 2	Fan	Stg 1	Stg 2	Fan	AUX CFM	Aux/ Emerg Mode
018	0.50	1/2	4	640	800	400	500	620	400	640	800	400	4	800
			3	600	750	375	470	590	375	600	750	375	3	750
			2	525	650	330	400	500	330	525	650	330	2	650
			1	450	550	280				450	550	280	1	650
024	0.50	1/2	4	900	1100	470	610	740	470	900	1100	470	4	1100
			3	780	950	420	540	660	420	780	950	420	3	950
			2	670	825	360	490	600	360	670	825	390	2	820
			1	550	675	300				550	675	340	1	690
030	0.50	1/2	4	920	1130	560	720	880	560	1000	1230	560	4	1230
			3	820	1000	500	640	780	500	900	1100	500	3	1100
			2	740	900	450	580	700	450	800	950	450	2	950
			1	660	800	400				640	780	400	1	780
036	0.50	1/2	4	1150	1400	700	900	1090	700	1150	1400	700	4	1400
			3	1020	1250	630	800	980	630	1020	1250	630	3	1350
			2	890	1080	540	690	840	540	890	1080	540	2	1350
			1	740	900	450				750	920	450	1	1350
042	0.50	1/2	4	1290	1580	790	1010	1230	790	1290	1580	790	4	1580
			3	1150	1400	700	900	1090	700	1150	1400	700	3	1400
			2	1050	1280	640	820	1000	640	1020	1240	640	2	1350
			1	920	1120	560				900	1080	560	1	1350
048	0.75	1	4	1420	1730	870	1110	1350	870	1520	1850	865	4	1850
			3	1270	1550	780	990	1210	780	1350	1650	775	3	1650
			2	1180	1440	720	920	1120	720	1110	1350	720	2	1350
			1	1050	1280	640				980	1250	640	1	1200
060	0.75	1	4	1680	2050	1030	1310	1600	1030	1870	2280	1030	4	2280
			3	1500	1830	910	1170	1420	910	1680	2050	910	3	2050
			2	1400	1700	850	1090	1330	850	1480	1800	850	2	1800
			1	1300	1580	790				1270	1550	790	1	1550
070	0.75	1	4	1830	2230	1100	1420	1740	1100	1830	2230	1100	4	2230
			3	1600	1950	980	1250	1520	980	1720	2100	980	3	2100
			2	1440	1750	880	1120	1360	880	1670	1950	880	2	1950
			1	1200	1580	790				1460	1780	790	1	1780

See ECM control section for details on setting taps.
Bold numbers indicate factory settings.
During Auxiliary operation the CFM will run at the higher of the Heating (Delay jumper) or AUX settings.
Airflow is controlled within 5% up to the Max ESP shown with wet coil.
Do not select Dehumidification mode if HP CFM is on setting 1.
All units AHRI/ISO/ASHRAE 13256-1 rated HP CFM Setting 3.

Tranquility® 20 (TS) Series with ClimaDry® Reheat Option (ECM Motor) - All Tranquility® 20 (TS) units with optional ECM fan motor automatically adjusts for the reheat coil. The small additional pressure drop of the reheat coil causes the ECM motor to slightly increase RPM to overcome the added pressure drop, and maintain selected CFM up to the maximum ESP.

Unit minimum entering air temperature while in the dehumidification, cooling, or continuous fan modes is **65ºF DB/55ºF WB**. Operation below this minimum may result in nuisance faults.

TS Blower Performance Data - Standard Unit - No Reheat (PSC Motor)

Airflow in CFM with wet coil and clean air filter

Model	Fan Speed	Rated Airflow	Min CFM	Airflow (cfm) at External Static Pressure (in. wg)										
				0.00	0.10	0.20	0.30	0.40	0.50	0.60	0.70	0.80	0.90	1.00
006	HI	240	150	317	305	285	271	250	230	203	168			
	MED			260	245	230	214	190	167					
	LO			216	201	189	156							
009	HI	300	225	393	378	364	346	325	253					
	MED			366	353	341	326	310	230					
	LO			326	316	303	290	274						
012	HI	350	300	520	500	479	453	403	347	312				
	MED			459	447	428	411	368	317					
	LO			371	368	358	345	315						
018	HI	600	450	704	711	693	690	675	640	598	515			
	MED			602	599	581	585	573	547	492				
	LO			531	527	517	506	495	462					
018 HS	HS HI	600	450	894	877	841	812	760	728	659				
	HS MED			765	755	738	711	668	640	602				
	HS LO			683	661	636	596	571	549					
024	HI	950	655	1111	1105	1066	1006	934	854	765	662			
	MED			890	879	854	818	770	708					
	LO			759	745	730	704	662						
024 HS	HS HI	950	655	1374	1351	1296	1228	1159	1090	1016	919	775		
	HS MED			1146	1151	1128	1091	1047	997	934	844	705		
	HS LO			1011	1015	999	945	911	863	785	656			
030	HI	1000	685	1374	1351	1296	1228	1159	1090	1016	919	775		
	MED			1146	1151	1128	1091	1047	997	934	844	705		
	LO			1011	1015	999	945	911	863	785				
030 HS	HS HI	1000	685	1342	1316	1249	1166	1083	1006	927	830	688		
	HS MED			1298	1250	1183	1110	1039	969	894	796	652		
	HS LO			1213	1172	1112	1046	982	919	850	758			
036	HI	1200	825	1375	1387	1377	1350	1307	1251	1182	1099	1003	890	
	MED			992	1013	1013	1002	986	967	941	900	832		
	LO			887	900	897	886	872	853	826				
036 HS	HS HI	1200	825	1751	1717	1664	1592	1503	1399	1285	1163	1039	919	
	HS MED			1538	1520	1485	1432	1361	1271	1165	1049	926		
	HS LO			1321	1294	1263	1226	1182	1130	1064	980	871		
042	HI	1400	960	1808	1759	1723	1680	1617	1524	1399	1247	1075		
	MED			1537	1518	1494	1459	1408	1338	1247	1134	1001		
	LO			1323	1309	1284	1246	1192	1122	1036				
042 HS	HS HI	1400	960	1805	1791	1760	1720	1674	1620	1552	1457	1318	1116	
	HS MED			1296	1297	1299	1299	1293	1276	1240	1176	1072		
	HS LO			991	998	1013	1019	1004	963					
048	HI	1600	1100	1805	1791	1760	1720	1674	1620	1552	1457	1318	1116	
	MED			1296	1297	1299	1299	1293	1276	1240	1176			
	LO													
048 HS	HS HI	1600	1100	1871	1889	1873	1833	1777	1706	1617	1504	1353	1150	
	HS MED			1663	1680	1686	1678	1650	1599	1520	1409	1262		
	HS LO			1479	1508	1521	1516	1492	1446	1376	1249	1148		
060	HI	1950	1500	2311	2300	2279	2257	2209	2140	2088	1990	1901	1856	1752
	MED			2058	2039	2016	1983	1949	1920	1874	1807	1750	1670	1582
	LO			1868	1858	1858	1838	1806	1792	1749	1699	1636	1570	
060 HS	HS HI	1950	1500	2510	2486	2455	2424	2377	2318	2247	2161	2078	1986	1855
	HS MED			2171	2162	2162	2153	2117	2085	2024	1971	1891	1823	1691
	HS LO			2010	2006	2006	2006	1977	1947	1892	1851	1782	1705	1600
070	HI	2100	1800	2510	2486	2455	2424	2377	2318	2247	2161	2078	1986	1855
	MED			2171	2162	2162	2153	2117	2085	2024	1971	1891	1823	
	LO			2010	2006	2006	2006	1977	1947	1892	1851			

Black areas denote ESP where operation is not recommended.
Units factory shipped on medium speed. Other speeds require field selection.
All airflow is rated and shown above at the lower voltage if unit is dual voltage rated, e.g. 208V for 208-230V units.
Only two speed fan (H & M) available on 575V units.
Performance stated is at the rated power supply, performance may vary as the power supply varies from the rated.
HS = High static fan option

TS Blower Performance Data - Units with ClimaDry® (PSC Motor)

Coil Face Velocity FPM	TSH/V/D with Reheat ESP Loss				
	TSH/V/D 018 In. of Water	TSH/V/D 024, 030 In. of Water	TSH/V/D 036 In. of Water	TSH/V/D 042, 048 In. of Water	TSH/V/D 060, 070 In. of Water
200	0.037	0.033	0.031	0.028	0.026
250	0.052	0.046	0.042	0.038	0.034
300	0.077	0.066	0.059	0.051	0.044
350	0.113	0.096	0.085	0.073	0.061
400	0.181	0.160	0.145	0.131	0.117
450	0.242	0.226	0.215	0.205	0.194
500	0.360	0.345	0.335	0.326	0.316

For TS units with ClimaDry® Reheat coil applications, calculate face velocity of the entering air. From the table above, find ESP for Reheat application. The loss includes wet coil loss.

Example:
Reheat coil loss can be determined from the above table. Coil velocity (FPM) = Airflow (CFM) / Face Area (sq. ft.)

1. TSH036 has a face area of 4.86 sq. ft. (see physical data table).
2. At 1,100 cfm, coil velocity (FPM) = 1,100 / 4.86 = 226 FPM
3. From above table, it will be necessary to subtract 0.037 from the blower performance ESP.
4. On medium speed, the TSH036 (without reheat - see blower table) can deliver 1,100 CFM at 0.28 in. wg. with the standard PSC motor; with the reheat coil, it now delivers 1,085 CFM at 0.28 in. wg. or 1,100 CFM at 0.24 in. wg.
5. If the decrease in airflow is acceptable, no changes are necessary. Otherwise, high speed fan should be used to overcome the pressure drop of the reheat coil.

Unit minimum entering air temperature while in the dehumidification, cooling, or continuous fan modes is **70ºF DB/61ºF WB**. Operation below this minimum may result in nuisance faults.

ECM Blower Control

The ECM fan is controlled by an interface board that converts thermostat inputs and field selectable CFM settings to signals used by the ECM motor controller. Units manufactured before July 2005 have version I (P/N 69243707). Units manufactured after July 2005 have version II (P/N 17B0019N01). Fan speeds are selected with jumpers for version I or via a nine position DIP switch for version II. To take full advantage of the ECM motor features, a multi-stage thermostat should be used (2-stage heat/2-stage cool or 3-stage heat/2-stage cool).

Note: Power must be off to the unit for at least three seconds before the ECM motor will recognize a speed change. The motor will recognize a change in the CFM Adjust or dehumidification mode settings while the unit is powered.

There are four different airflow settings from lowest airflow rate (speed tap 1) to the highest airflow rate (speed tap 4).

The charts below indicate settings for Version II of the ECM interface board, followed by detailed information for each setting.

Cooling settings

Tap Setting	Version II 17B0019N01 DIP Switch	
	SW1	SW2
1	ON	ON
2	ON	OFF
3	OFF	ON
4	OFF	OFF

Heating settings

Tap Setting	Version II 17B0019N01 DIP Switch	
	SW3	SW4
1	ON	ON
2	ON	OFF
3	OFF	ON
4	OFF	OFF

CFM Adjust settings

Tap Setting	Version II 17B0019N01 DIP Switch	
	SW7	SW8
TEST	ON	ON
-	ON	OFF
+	OFF	ON
NORM	OFF	OFF

Dehum Mode settings

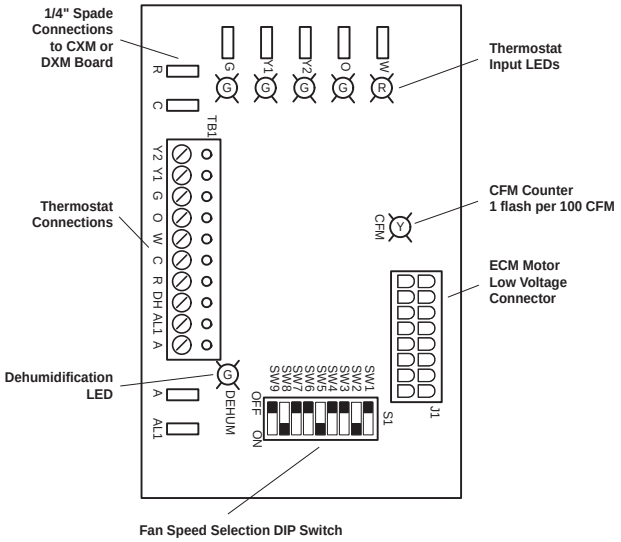
Tap Setting	Version II 17B0019N01 DIP Switch
	SW9
NORM	ON
Dehumid	OFF

Aux/Emerg Heat settings

Tap Setting	Version II 17B0019N01 DIP Switch	
	SW5	SW6
1	ON	ON
2	ON	OFF
3	OFF	ON
4	OFF	OFF

Cooling Settings: The cooling setting determines the cooling (normal) CFM for all units with ECM motor. Cooling (normal) setting is used when the unit is not in dehumidification mode. Tap 1 is the lowest CFM setting, while tap 4 is the highest CFM setting. To avoid air coil freeze-up, tap 1 may not be used if the dehumidification mode is selected. Consult submittal data or specifications catalog for the specific unit series and model to correlate speed tap setting to airflow in CFM.

Figure 23: ECM Version II Interface Layout



Heating Settings: The heating setting determines the heating CFM. Tap 1 is the lowest CFM setting, while tap 4 is the highest CFM setting. Consult submittal data or specifications catalog for the specific unit series and model to correlate speed tap setting to airflow in CFM.

Auxiliary/Emergency Heat Settings: The auxiliary/emergency heat setting determines the CFM when the unit is in auxiliary heat or emergency heat mode. This setting is used for residential units with internal electric heat. When auxiliary electric heat is energized (i.e. compressor and electric heat), the greater of the auxiliary/emergency or heating setting will be used. A "G" (fan) signal must be present from the thermostat for electric heat to operate. Consult the submittal data or specifications catalog for the specific unit series and model to correlate speed tap setting to airflow in CFM.

CFM Adjust Settings: The CFM adjust setting allows four selections. The NORM setting is the factory default position. The + or – settings adjust the airflow by +/- 5%. The +/- settings are used to "fine tune" airflow adjustments. The TEST setting runs the ECM motor at 400 CFM/ton, example 2-ton = 800 CFM.

Dehumidification Mode Settings: The dehumidification mode setting provides field selection of humidity control. When operating in the normal mode, the cooling airflow settings are determined by the cooling tap setting above.

ECM Blower Control

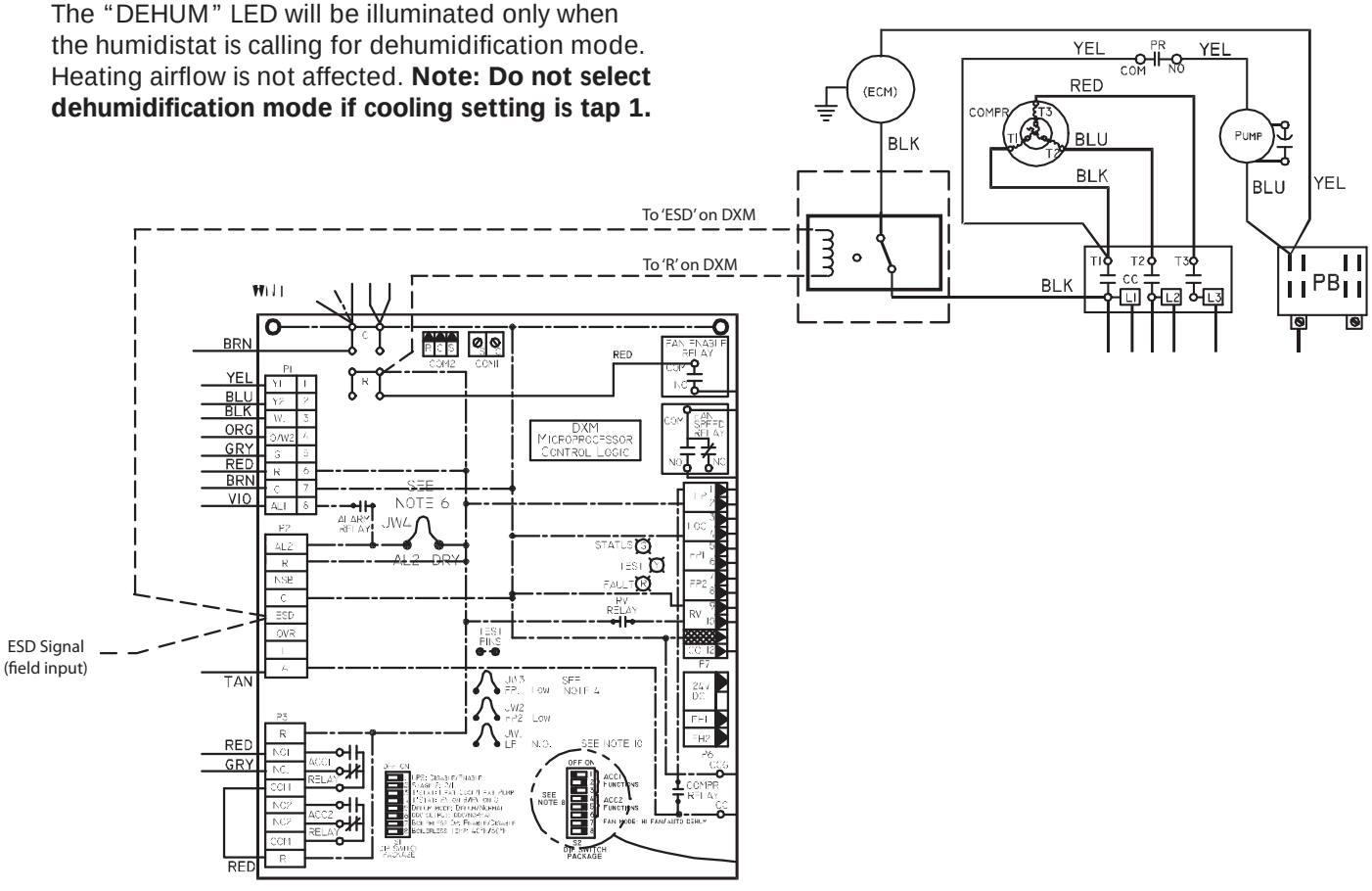
When dehumidification is enabled there is a reduction in airflow in cooling to increase the moisture removal of the heat pump. Consult submittal data or specifications catalog for the specific unit series and model to correlate speed tap to airflow in CFM. The dehumidification mode can be enabled in two ways.

1. **Constant Dehumidification Mode:** When the dehumidification mode is selected (via DIP switch or jumper setting), the ECM motor will operatewith a multiplier applied to the cooling CFM settings (approx. 20-25% lower airflow). Any time the unit is running in the cooling mode, it will operate at the lower airflow to improve latent capacity. The "DEHUM" LED will be illuminated at all times. Heating airflow is not affected **Note: Do not select dehumidification mode if cooling setting is tap 1.**
2. **Automatic (Humidistat-controlled) Dehumidification Mode:** When the dehumidification mode is selected (via DIP switch or jumper setting AND a humidistat is connected to terminal DH(version II) or HUM (version I), the cooling airflow will only be reduced when the humidistat senses that additional dehumidification is required. The DH (or HUM) terminal is reverse logic. Therefore, a humidistat (not dehumidistat) is required. The "DEHUM" LED will be illuminated only when the humidistat is calling for dehumidification mode. Heating airflow is not affected. **Note: Do not select dehumidification mode if cooling setting is tap 1.**

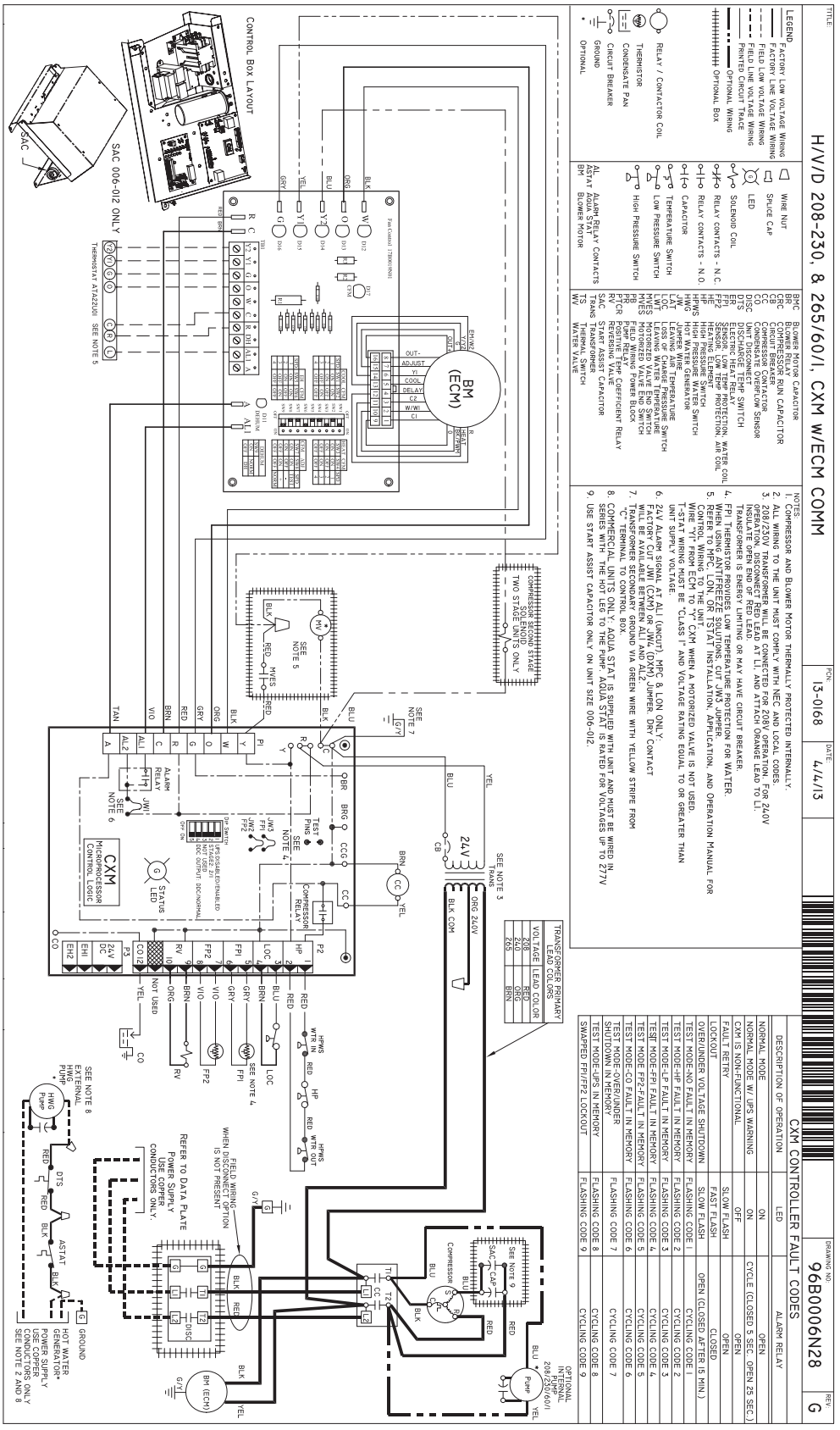
The ECM motor includes "soft start" and "ramp down" features. The soft start feature is a gentle increase of motor rpm at blower start up. This creates a much quieter blower start cycle.

The ramp down feature allows the blower to slowly decrease rpm to a full stop at the end of each blower cycle. This creates a much quieter end to each blower cycle and adds overall unit efficiency.

The ramp down feature may be eliminated during an ESD (Emergency Shut Down) situation when using a DXM unit controller. A DPDT relay is required to break the line voltage to the ECM motor during ESD. This relay can be wired as shown below to eliminate the ramp down (and operation) of the ECM blower motor.

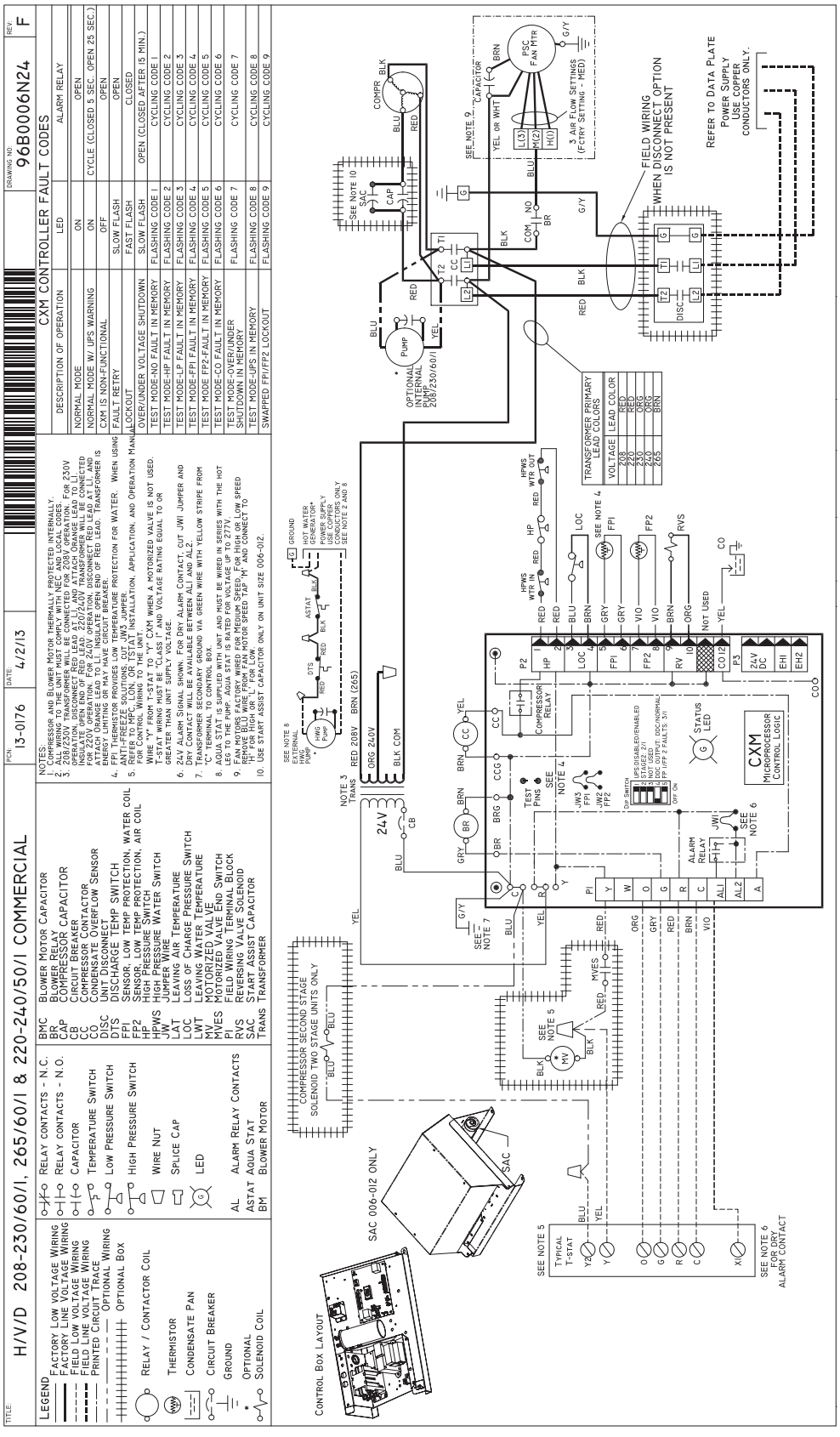


Typical Wiring Diagram - Units with CXM Board and ECM Fan Motor (Single Phase)

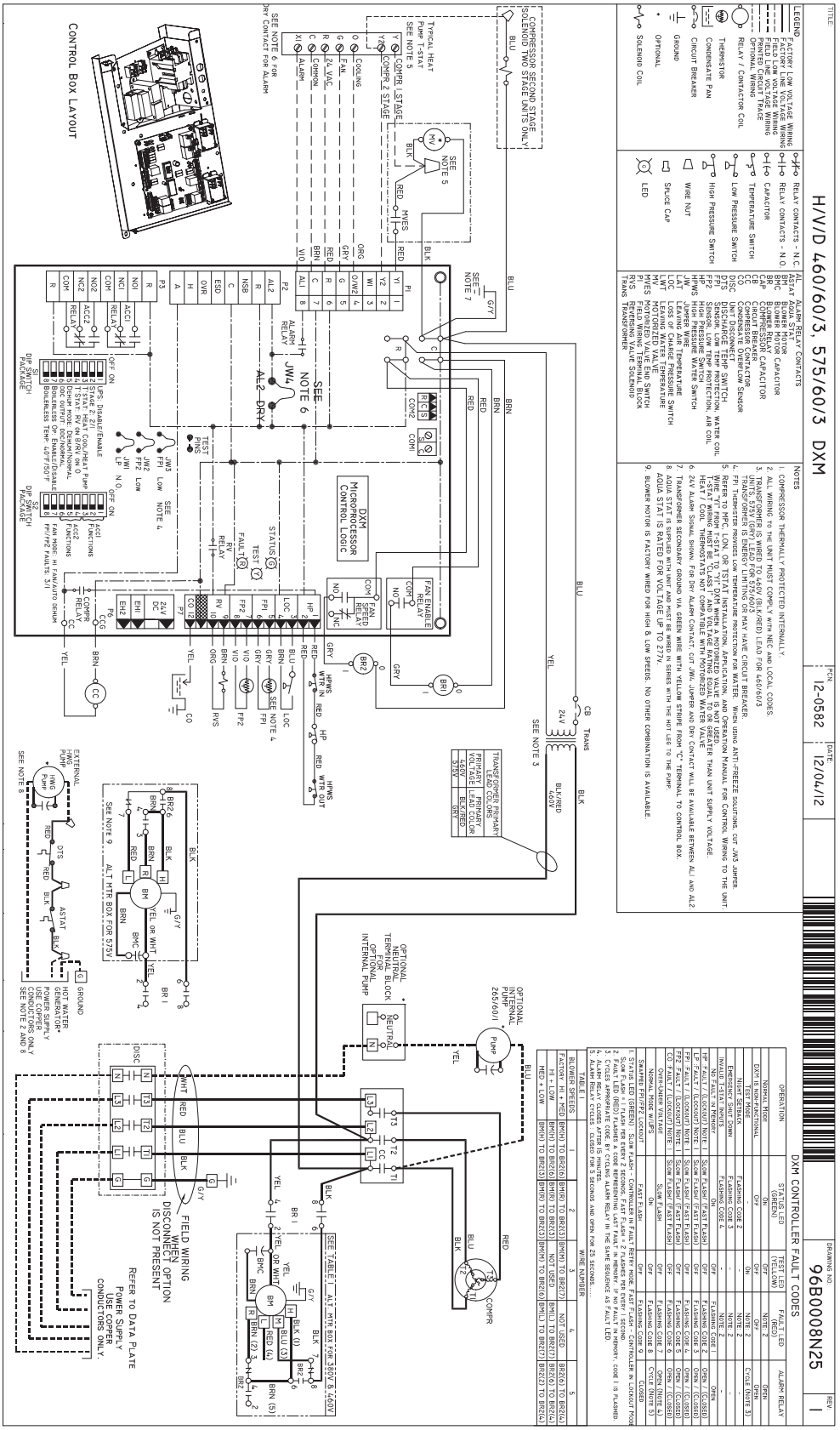

TITLE
H/V/D 208-230, & 265/60/1, CXM w/ECM COMM
PCN: 13-0168
DATE: 4/4/13
DRAWING NO: 96B0006N28
REV: G
LEGEND
FACTORY LOW VOLTAGE WIRING
FACTORY LINE VOLTAGE WIRING
FIELD LOW VOLTAGE WIRING
FIELD LINE VOLTAGE WIRING
PRINTED CIRCUIT TRACE
OPTIONAL WIRING
OPTIONAL BOX
RELAY / CONTACTOR COIL
THERMISTOR
CONDENSATE PAN
CIRCUIT BREAKER
GROUND
OPTIONAL
WIRE NUT
SPLICE CAP
LED
SOLENOID COIL
RELAY CONTACTS - N.C.
RELAY CONTACTS - N.O.
CAPACITOR
TEMPERATURE SWITCH
LOW PRESSURE SWITCH
HIGH PRESSURE SWITCH
ALARM RELAY CONTACTS
AQUA STAT
BLOWER MOTOR
BMC BLOWER MOTOR CAPACITOR
BR BLOWER RELAY
CRC COMPRESSOR RUN CAPACITOR
CC COMPRESSOR CONTACTOR
COS CONDENSATE OVERFLOW SENSOR
DISC DISCHARGE TEMP SWITCH
DTS DISCHARGE TEMP SENSOR
EH ELECTRIC HEAT RELAY
FP2 HEATING ELEMENT
HE SENSOR, LOW TEMP PROTECTION, AIR COIL
HP HIGH PRESSURE SWITCH
HPWS HIGH PRESSURE WATER SWITCH
HWG HOT WATER GENERATOR
LAT LEAVING AIR TEMPERATURE
LOC LOSS OF CHARGE SWITCH
LWT LEAVING WATER TEMPERATURE
MVES MOTORIZED VALVE END SWITCH
MV MOTORIZED WATER VALVE
PB FIELD WIRING POWER BLOCK
PR PUMP RELAY
RV REVERSING VALVE
SCR SOLID STATE CREEPICENT RELAY
SAC START ASSIST CAPACITOR
TRANS TRANSFORMER
TS THERMOSTAT
WV WATER VALVE
NOTES:
1. COMPRESSOR AND BLOWER MOTOR THERMALLY PROTECTED INTERNALLY.
2. ALL WIRING TO THE UNIT MUST COMPLY WITH NEC AND LOCAL CODES.
3. 208/230V TRANSFORMER WILL BE CONNECTED FOR 208V OPERATION. FOR 240V OPERATION, DISCONNECT RED LEAD AT L1, AND ATTACH ORANGE LEAD TO L1. TRANSFORMER IS ENERGY LIMITING OR MAY HAVE CIRCUIT BREAKER.
4. FP1 THERMISTOR PROVIDES LOW TEMPERATURE PROTECTION FOR WATER. WHEN USING ANTIFREEZE SOLUTIONS, CUT JW3 JUMPER.
5. REFER TO MPC, LON, OR TSTAT INSTALLATION, APPLICATION, AND OPERATION MANUAL FOR CONTROL WIRING.
6. 24V ALARM SIGNAL AT AL1 (UNCUT). MPC & LON ONLY: FACTORY CUT JW1 (CXM) OR JW4 (DXM) JUMPER. Dry Contact
7. TRANSFORMER SECONDARY AL1 AND AL2 VIA GREEN WIRE WITH YELLOW STRIPE FROM "C" TERMINAL TO CONTROL BOX.
8. COMMERCIAL UNITS ONLY: AQUA STAT IS SUPPLIED WITH UNIT AND MUST BE WIRED IN SERIES WITH THE HOT LEG TO THE PUMP. AQUA STAT IS RATED FOR VOLTAGES UP TO 277V
9. USE START ASSIST CAPACITOR ONLY ON UNIT SIZE 006-012.
CXM CONTROLLER FAULT CODES
DESCRIPTION OF OPERATION
LED
ALARM RELAY
NORMAL MODE — ON — OPEN
NORMAL MODE W/ UPS WARNING — ON — CYCLE (CLOSED 5 SEC. OPEN 25 SEC.)
CXM IS NON-FUNCTIONAL — OFF — SLOW FLASH — OPEN
FAULT RETRY — SLOW FLASH — FAST FLASH — CLOSED
LOCKOUT — FAST FLASH — CLOSED
OVER/UNDER VOLTAGE SHUTDOWN — SLOW FLASH — OPEN (CLOSED AFTER 15 MIN.)
TEST MODE-NO FAULT IN MEMORY — FLASHING CODE 1 — CYCLING CODE 1
TEST MODE-HP FAULT IN MEMORY — FLASHING CODE 2 — CYCLING CODE 2
TEST MODE-LP FAULT IN MEMORY — FLASHING CODE 3 — CYCLING CODE 3
TEST MODE-FP1 FAULT IN MEMORY — FLASHING CODE 4 — CYCLING CODE 4
TEST MODE-FP2-FAULT IN MEMORY — FLASHING CODE 5 — CYCLING CODE 5
TEST MODE-CO FAULT IN MEMORY — FLASHING CODE 6 — CYCLING CODE 6
TEST MODE-OVER/UNDER SHUTDOWN IN MEMORY — FLASHING CODE 7 — CYCLING CODE 7
TEST MODE-UPS IN MEMORY — FLASHING CODE 8 — CYCLING CODE 8
SMARTED FRT/FP2 LOCKOUT — FLASHING CODE 9 — CYCLING CODE 9
CONTROL BOX LAYOUT
SAC
SAC 006-012 ONLY
THERMISTAT ATA2201 SEE NOTE 5
BM (ECM)
OUT-ADJUST
DELAY
W/ W1
CXM
MICROPROCESSOR CONTROL LOGIC
STATUS LED
ALARM RELAY
JW1
JW3 FP1
JW4 FP2
TEST PINS
SEE NOTE 4
SEE NOTE 6
SEE NOTE 7
SEE NOTE 5
TWO STAGE COMPRESSOR SECOND STAGE
TWO STAGE UNITS ONLY
24V CB
SEE NOTE 3 TRANS
TRANSFORMER PRIMARY VOLTAGE LEAD COLOR
208 RED
230 ORG
240 ORG
265 BRN
COMPRESSOR RELAY
HP
LOC
FP1
FP2
RV
EH1
EH2
24V DC
P1
P2
P3
CO
NOT USED
HPWS WTR IN
HPWS WTR OUT
SEE NOTE 4
SEE NOTE 8
EXTERNAL HWG PUMP*
FIELD WIRING DISCONNECT OPTION WHEN LOCKOUT IS NOT PRESENT
REFER TO DATA PLATE
POWER SUPPLY USE COPPER CONDUCTORS ONLY.
SEE NOTE 9
COMPRESSOR
SAC CAP
OPTIONAL EXTERNAL PUMP 208/230/60/1
Pump
ASTAT
HOT WATER GENERATOR*
POWER SUPPLY USE COPPER CONDUCTORS ONLY SEE NOTE 2 AND 8
GROUND

Tranquility® 20 (TS) Series
Rev.:02/05/14

Typical Wiring Diagram - Units with CXM Board and PSC Fan Motor (Single Phase)

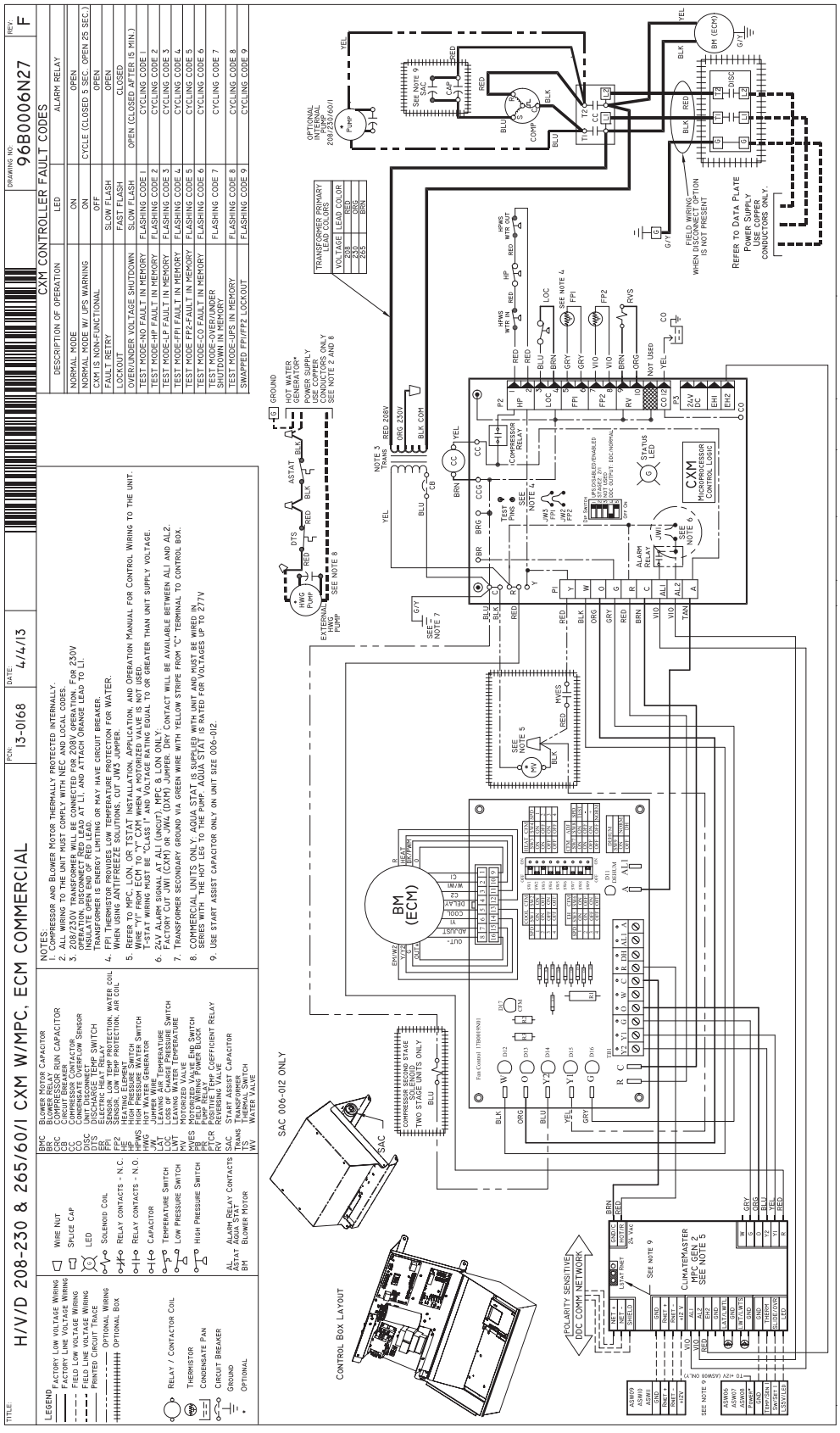

TITLE: H/V/D 208-230/60/1, 265/60/1 & 220-240/50/1 COMMERCIAL
PCN: I3-0176
DATE: 4/2/13
DRAWING NO: 96B0006N24
REV: F
LEGEND
Factory Low Voltage Wiring
Factory Line Voltage Wiring
Field Low Voltage Wiring
Field Line Voltage Wiring
Printed Circuit Trace
Optional Wiring
Optional Box
Relay / Contactor Coil
Thermistor
Condensate Pan
Circuit Breaker
Ground
Optional
Solenoid Coil
Relay contacts - N.C.
Relay contacts - N.O.
Capacitor
Temperature Switch
Low Pressure Switch
High Pressure Switch
Wire Nut
Splice Cap
LED
Alarm Relay Contacts
Aqua Stat
Blower Motor
BMC Blower Motor Capacitor
BR Blower Relay
CAP Compressor Capacitor
CB Circuit Breaker
CC Compressor Contactor
CO Condensate Overflow Sensor
DISC Disconnect
DTS Discharge Temp Switch
FPS Sensor, Low Temp Protection, Water Coil
FP2 Sensor, Low Temp Protection, Air Coil
HP High Pressure Switch
HPWS High Pressure Water Switch
JW Jumper Wire
LAT Leaving Air Temperature
LOC Loss of Charge Pressure Switch
LWT Leaving Water Temperature
MV Motorized Valve
MVES Motorized Valve End Switch
PI Field Wiring Terminal Block
RVS Reversing Valve Solenoid
SAC Start Assist Capacitor
TRANS Transformer
AL Alarm Relay Contacts
ASTAT Aqua Stat
BM Blower Motor
NOTES:
1. COMPRESSOR AND BLOWER MOTOR THERMALLY PROTECTED INTERNALLY.
2. ALL WIRING MUST COMPLY WITH NEC AND LOCAL CODES.
3. 208 VOLT TRANSFORMER MUST BE CONNECTED TO 230V FOR 230V OPERATION. FOR 230V OPERATION, DISCONNECT RED LEAD AT T1 AND ATTACH ORANGE LEAD TO T1. INSULATE BOTH ENDS OF RED LEAD. TRANSFORMER IS FACTORY CONNECTED FOR 265V OPERATION. FOR 240V OPERATION, DISCONNECT RED LEAD AT T2 AND ATTACH ORANGE LEAD TO T1. INSULATE OPEN END OF RED LEAD. TRANSFORMER IS FACTORY CONNECTED FOR 265V OPERATION.
4. FPI THERMISTOR PROVIDES LOW TEMPERATURE PROTECTION FOR WATER. WHEN USING ANTI-FREEZE SOLUTIONS, CUT JW3 JUMPER.
5. REFER TO MPC LON, OR TSTAT INSTALLATION, APPLICATION, AND OPERATION MANUAL FOR CONTROL WIRING TO THESE UNITS.
6. WIRE "Y" FROM T-STAT TO "Y" CXM WHEN A MOTORIZED VALVE IS NOT USED. T-STAT WIRING MUST BE "CLASS 1" AND VOLTAGE RATING EQUAL TO OR GREATER THAN UNIT SUPPLY VOLTAGE.
7. 24V ALARM SIGNAL SHOWN. FOR DRY ALARM CONTACT, CUT JW1 JUMPER AND DRY CONTACT WILL BE AVAILABLE BETWEEN AL1 AND AL2.
8. AQUA STAT IS SUPPLIED WITH UNIT AND MUST BE WIRED IN SERIES WITH THE HOT LEG TO THE PUMP. AQUA STAT IS RATED FOR VOLTAGE UP TO 277V.
9. FAN MOTORS FACTORY WIRED FOR MEDIUM SPEED. FOR HIGH OR LOW SPEED REFER TO MOTOR LABEL DIAGRAM AND RECONNECT TO "H" FOR HIGH OR "L" FOR LOW.
10. USE START ASSIST CAPACITOR ONLY ON UNIT SIZE 006-012.
CXM CONTROLLER FAULT CODES
DESCRIPTION OF OPERATION | LED | ALARM RELAY
NORMAL MODE | ON | OPEN
NORMAL MODE W/ UPS WARNING | ON | CYCLE (CLOSED 5 SEC. OPEN 25 SEC.)
CXM IS NON-FUNCTIONAL | OFF | OPEN
FAULT RETRY | SLOW FLASH | OPEN
LOCKOUT | FAST FLASH | CLOSED
OVER/UNDER VOLTAGE SHUTDOWN | SLOW FLASH | OPEN (CLOSED AFTER 15 MIN.)
TEST MODE-NO FAULT IN MEMORY | FLASHING CODE 1 | CYCLING CODE 1
TEST MODE-HP FAULT IN MEMORY | FLASHING CODE 2 | CYCLING CODE 2
TEST MODE-LP FAULT IN MEMORY | FLASHING CODE 3 | CYCLING CODE 3
TEST MODE-FPI FAULT IN MEMORY | FLASHING CODE 4 | CYCLING CODE 4
TEST MODE FP2-FAULT IN MEMORY | FLASHING CODE 5 | CYCLING CODE 5
TEST MODE-CO FAULT IN MEMORY | FLASHING CODE 6 | CYCLING CODE 6
TEST MODE-OVER/UNDER SHUTDOWN IN MEMORY | FLASHING CODE 7 | CYCLING CODE 7
TEST MODE-UPS IN MEMORY | FLASHING CODE 8 | CYCLING CODE 8
SWAPPED FPI/FP2 LOCKOUT | FLASHING CODE 9 | CYCLING CODE 9
TRANSFORMER PRIMARY LEAD COLORS
VOLTAGE | LEAD COLOR
208 | RED
220 | RED
230 | ORG
240 | ORG
265 | BRN
CONTROL BOX LAYOUT
SAC 006-012 ONLY
SAC
COMPRESSOR SECOND STAGE SOLENOID TWO STAGE UNITS ONLY
SEE NOTE 5
SEE NOTE 6 FOR DRY ALARM CONTACT
SEE NOTE 7
SEE NOTE 8
SEE NOTE 9
SEE NOTE 10
SEE NOTE 2 AND 8
SEE NOTE 3 FOR VOLTAGES
SEE NOTE 4
SEE NOTE 6
TYPICAL T-STAT
OPTIONAL INTERNAL 208/230/60/1
FIELD WIRING WHEN DISCONNECT OPTION IS NOT PRESENT
REFER TO DATA PLATE POWER SUPPLY USE COPPER CONDUCTORS ONLY.
3 AIR FLOW SETTINGS (FACTRY SETTING - MED)
CAPACITOR
YEL OR WHT
COMPRESSOR RELAY
CXM MICROPROCESSOR CONTROL LOGIC
STATUS LED
ALARM RELAY
COMPR
PUMP
PSC FAN MTR
HWG PUMP
ASTAT
DTS
HOT WATER GENERATOR*
POWER SUPPLY 40 VA MINIMUM
HPWS WITH NUT
HP
LOC
FPI
FP2
RVS
CO
Not Used
24V DC
EH1
EH2
P1
P2
P3
TEST PINS
JW3
JW2
JW1
DIP SWITCH
UPS DISABLED/ENABLED
STAGE2: 2:1
NORMAL/REVERSE
ODC OUTPUT, ODC/NORMAL
FP1/FP2 FAULTS: 3/1
OFF ON
24V
CB
BLK COM
ORG 240V
RED 208V
BRN (265)
BLU
YEL
ORG
GRY
RED
BRN
VIO
BLK
BRG
GRY
BR
BRN
CC
CCG
G/Y
DISC
L1
L2
T1
T2
CC
NO
COM
BR
BLU
RED
BLK
G/Y
G
F1
F2
M(1)
M(2)
L(3)
H(1)
MV
MVES
PUMP
OPTIONAL INTERNAL 208/230/60/1
FIELD WIRING WHEN DISCONNECT OPTION IS NOT PRESENT
REFER TO DATA PLATE POWER SUPPLY USE COPPER CONDUCTORS ONLY.

Typical Wiring Diagram - Units with DXM Board and PSC Fan Motor (Three Phase)


H/V/D 460/60/3, 575/60/3 DXM
DRAWING NO 96B0008N25
REV 1
DATE 12/04/12
ECN 12-0582
NOTES
DXM CONTROLLER FAULT CODES
OPERATION
STATUS LED (GRN)
FAULT LED (TEST LED)
ALARM RELAY
DXM CONTROL BOARD
CONTROL BOX LAYOUT
TYPICAL HEAT PUMP T-STAT SEE NOTE 5
SEE NOTE 6 FOR DRY CONTACT FOR ALARM
COMPRESSOR SECOND STAGE (SOLENOID) TWO STAGE UNITS ONLY
SEE NOTE 7
SEE NOTE 6
SEE NOTE 4
SEE NOTE 3
SEE NOTE 9
SEE NOTE 8
DIP SWITCH PACKAGE
MICROPROCESSOR CONTROL LOGIC
DXM
ALARM RELAY
FAN ENABLE RELAY
FAN SPEED RELAY
REVERSING VALVE RELAY
COMPR RELAY
ALARM RELAY CONTACTS
TRANSFORMER PRIMARY VOLTAGE
PRIMARY LEAD COLOR
TRANSFORMER SECONDARY
24V LEAD COLOR
OPTIONAL EXTERNAL PUMP 265/60//
OPTIONAL NEUTRAL TERMINAL BLOCK FOR OPTIONAL INTERNAL PUMP
FIELD WIRING DISCONNECT OPTION IS NOT PRESENT
REFER TO DATA PLATE FOR POWER SUPPLY. USE COPPER CONDUCTORS ONLY.
HOT WATER GENERATOR PUMP RELAY. USE COPPER CONDUCTORS ONLY
EXTERNAL HWG PUMP
ALT MTR BOX FOR 575V
ALT MTR BOX FOR 380V & 460V
LEGEND
NOTES
1. COMPRESSOR THERMALLY PROTECTED INTERNALLY.
2. ALL WIRING TO THE UNIT MUST COMPLY WITH NEC AND LOCAL CODES.
3. UNITS SHIPPED FOR 460/60/3 (RED) LEAD FOR 460/60/3 TRANSFORMER IS ENERGY LIMITING OR MAY HAVE CIRCUIT BREAKER.
4. FPT THERMISTOR PROVIDES LOW TEMPERATURE PROTECTION FOR WATER. WHEN USING ANTI-FREEZE SOLUTIONS, CUT JW3 JUMPER FOR FREEZE DETECTION TO 10°F (-12°C) SEE APPLICATION MANUAL FOR CONTROL WIRING TO THE UNIT.
5. WIRE "Y1" FROM T-STAT TO "Y1" OF DXM WHEN A MODULATING VALVE IS NOT USED. T-STAT WIRING MUST BE "CLASS 1" AND VOLTAGE RATING EQUAL TO OR GREATER THAN UNIT SUPPLY VOLTAGE.
6. 24V ALARM SIGNAL SHOWN. FOR DRY ALARM CONTACT, CUT JW4 JUMPER AND DRY CONTACT WILL BE AVAILABLE BETWEEN AL1 AND AL2.
7. TRANSFORMER SECONDARY GROUND VIA GREEN WIRE WITH YELLOW STRIPE FROM "C" TERMINAL TO CONTROL BOX.
8. AQUA STAT IS SUPPLIED WITH UNIT AND MUST BE WIRED IN SERIES WITH THE HOT LEG TO THE PUMP.
AQUA STAT IS RATED FOR VOLTAGE UP TO 277V.
9. BLOWER MOTOR IS FACTORY WIRED FOR HIGH & LOW SPEEDS. NO OTHER COMBINATION IS AVAILABLE.

Tranquility® 20 (TS) Series
Rev.:02/05/14

Typical Wiring Diagram - Units with CXM Board, ECM Fan Motor, and MPC (DDC) CONTROLS (SINGLE PHASE)


TITLE: H/V/D 208-230 & 265/60/1 CXM W/MPC, ECM COMMERCIAL
PCN: 13-0168
DATE: 4/4/13
DRAWING NO: 96B0006N27
REV: F
CXM CONTROLLER FAULT CODES
DESCRIPTION OF OPERATION | LED | ALARM RELAY
NORMAL MODE | ON | OPEN
NORMAL MODE W/ UPS WARNING | ON | CYCLE (CLOSED 5 SEC., OPEN 25 SEC.)
CXM IS NON-FUNCTIONAL | OFF | OPEN
FAULT RETRY | SLOW FLASH | OPEN
LOCKOUT | FAST FLASH | CLOSED
OVER/UNDER VOLTAGE SHUTDOWN | SLOW FLASH | OPEN (CLOSED AFTER 15 MIN.)
TEST MODE-NO FAULT IN MEMORY | FLASHING CODE 1 | CYCLING CODE 1
TEST MODE-HP FAULT IN MEMORY | FLASHING CODE 2 | CYCLING CODE 2
TEST MODE-LP FAULT IN MEMORY | FLASHING CODE 3 | CYCLING CODE 3
TEST MODE-FPI FAULT IN MEMORY | FLASHING CODE 4 | CYCLING CODE 4
TEST MODE FP2-FAULT IN MEMORY | FLASHING CODE 5 | CYCLING CODE 5
TEST MODE-CO FAULT IN MEMORY | FLASHING CODE 6 | CYCLING CODE 6
TEST MODE-OVER/UNDER VOLTAGE SHUTDOWN | FLASHING CODE 7 | CYCLING CODE 7
TEST MODE-UPS IN MEMORY | FLASHING CODE 8 | CYCLING CODE 8
SWAPPED FPI/FP2 LOCKOUT | FLASHING CODE 9 | CYCLING CODE 9
NOTES:
1. COMPRESSOR AND BLOWER MOTOR THERMALLY PROTECTED INTERNALLY.
2. ALL WIRING TO THE UNIT MUST COMPLY WITH NEC AND LOCAL CODES.
3. 208/230V TRANSFORMER WILL BE CONNECTED FOR 208V OPERATION. FOR 230V OPERATION, DISCONNECT RED LEAD AT L1, AND ATTACH ORANGE LEAD TO L1. 265V TRANSFORMER IS FACTORY WIRED FOR 265V.
4. FPI THERMISTOR PROVIDES LOW TEMPERATURE PROTECTION FOR WATER. WHEN USING ANTIFREEZE SOLUTIONS, CUT JW3 JUMPER.
5. REFER TO MPC, LON, OR TSTAT INSTALLATION, APPLICATION, AND OPERATION MANUAL FOR CONTROL WIRING TO THE UNIT. WHEN USING MPC OR LON, CUT JW2 JUMPER. DIP SWITCH SETTINGS MUST BE SET AS SHOWN IN T-STAT WIRING MUST BE "CLASS 1" AND VOLTAGE RATING EQUAL TO OR GREATER THAN UNIT SUPPLY VOLTAGE.
6. 24V ALARM SIGNAL AT AL1 (UNCUT), MPC & LON ONLY. FACTORY CUT JW1 (CXM) OR JW4 (DXM) JUMPER. DRY CONTACT WILL BE AVAILABLE BETWEEN AL1 AND AL2.
7. TRANSFORMER SECONDARY GROUND VIA GREEN WIRE WITH YELLOW STRIPE FROM "C" TERMINAL TO CONTROL BOX.
8. COMMERCIAL UNITS ONLY: AQUA STAT IS SUPPLIED WITH UNIT AND MUST BE WIRED IN SERIES WITH THE HOT LEG TO THE PUMP. AQUA STAT IS RATED FOR VOLTAGES UP TO 277V
9. USE START ASSIST CAPACITOR ONLY ON UNIT SIZE 006-012.
LEGEND
FACTORY LOW VOLTAGE WIRING
FACTORY LINE VOLTAGE WIRING
FIELD LOW VOLTAGE WIRING
FIELD LINE VOLTAGE WIRING
PRINTED CIRCUIT TRACE
OPTIONAL WIRING
OPTIONAL BOX
RELAY / CONTACTOR COIL
THERMISTOR
CONDENSATE PAN
CIRCUIT BREAKER
GROUND
OPTIONAL
WIRE NUT
SPLICE CAP
LED
SOLENOID COIL
RELAY CONTACTS - N.C.
RELAY CONTACTS - N.O.
CAPACITOR
TEMPERATURE SWITCH
LOW PRESSURE SWITCH
HIGH PRESSURE SWITCH
BMC BLOWER MOTOR CAPACITOR
BR BLOWER RELAY
CRC COMPRESSOR RUN CAPACITOR
CB CIRCUIT BREAKER
CC COMPRESSOR CONTACTOR
DFS DISCHARGE FLOW/FLOW SENSOR
DISC UNIT DISCONNECT
DTS DISCHARGE TEMP SWITCH
FP1 SENSOR, LOW TEMP PROTECTION
FP2 SENSOR, LOW TEMP PROTECTION
HP HIGH PRESSURE SWITCH
HPWS HIGH PRESSURE WATER SWITCH
HWG HOT WATER GENERATOR
JW JUMPER WIRE
LAT LEAVING AIR TEMPERATURE
LOC LOSS OF CHARGE PRESSURE SWITCH
LWT LEAVING WATER TEMPERATURE
MV MOTORIZED VALVE
MVES MOTORIZED VALVE END SWITCH
PR PUMP RELAY / POWER BLOCK
PTCR POSITIVE TEMP COEFFICIENT RESISTOR
RV REVERSING VALVE
AL ALARM RELAY CONTACTS
ASTAT AQUA STAT
BM BLOWER MOTOR
SAC START ASSIST CAPACITOR
TRANS TRANSFORMER
TWV THERMAL WATER VALVE
WV WATER VALVE
TRANSFORMER PRIMARY VOLTAGE TAP
VOLTAGE | LEAD COLOR
208 | RED
230 | ORG
265 | BRN
CXM MICROPROCESSOR CONTROL LOGIC
STATUS LED
COMPRESSOR RELAY
ALARM RELAY
DIP SWITCH
JW1
JW2 FP2
JW3 FP1
SEE NOTE 4
SEE NOTE 6
SEE NOTE 5
SEE NOTE 7
SEE NOTE 8
SEE NOTE 9
HWG PUMP
EXTERNAL HWG PUMP
HOT WATER GENERATOR* POWER SUPPLY USE COPPER CONDUCTORS ONLY SEE NOTE 2 AND 8
OPTIONAL INTERNAL HWG PUMP 208/230/60/1
FIELD WIRING WHEN DISCONNECT OPTION IS NOT PRESENT
REFER TO DATA PLATE POWER SUPPLY USE COPPER CONDUCTORS ONLY.
NOTE 1 TRANS
208V 230V
ORG RED
BLK COM
HWPS WTR OUT
HWPS WTR IN
HP
LOC
FPI
FP2
RVS
CO
NOT USED
P1
P2
P3
2ΔV DC
EHI
EH2
BM (ECM)
BM(MV)
VCA
OUT1
OUT2
HEAT
COOL
DEHUM
DIP SWITCH
FAN CONTROL
TB1
R C W G O Y1 Y2
W O Y2 Y1 G
SAC 006-012 ONLY
SAC
CONTROL BOX LAYOUT
COMPRESSOR SECOND STAGE
TWO STAGE UNITS ONLY
POLARITY SENSITIVE DDC COMM NETWORK
CLIMATEMASTER MPC GEN 2
SEE NOTE 5
SEE NOTE 9
TO 42V (CSW08 ONLY)
ASW09 ASW10 ASW11 ASW12 ASW06 ASW07 ASW08 ASW13 ASW14 ASW15

CXM Controls

CXM Control - For detailed control information, see CXM Application, Operation and Maintenance (AOM) manual (part # 97B0003N12).

Field Selectable Inputs - Test mode: Test mode allows the service technician to check the operation of the control in a timely manner. At board, momentarily shorting the test terminals or externally, momentarily push test button (See Fig 10), the CXM control enters a 20 minute test mode period in which all time delays are sped up 15 times. Upon entering test mode, the status LED will flash a code representing the last fault. For diagnostic ease at the thermostat, the alarm relay will also cycle during test mode. The alarm relay will cycle on and off similar to the status LED to indicate a code representing the last fault, at the thermostat. Test mode can be exited by shorting the test terminals or holding button for 3 seconds.
Retry Mode: If the control is attempting a retry of a fault, the status LED will slow flash (slow flash = one flash every 2 seconds) to indicate the control is in the process of retrying.

Field Configuration Options - Note: In the following field configuration options, jumper wires should be clipped ONLY when power is removed from the CXM control.

Water coil low temperature limit setting: Jumper 3 (JW3-LT1 Low Temp) provides field selection of temperature limit setting for LT1 of 30°F or 10°F [-1°F or -12°C] (refrigerant temperature).
Not Clipped = 30°F [-1°C]. Clipped = 10°F [-12°C].
Air coil low temperature limit setting: Jumper 2 (JW2-LT2 Low Temp) provides field selection of temperature limit setting for LT2 of 30°F or 10°F [-1°F or -12°C] (refrigerant temperature). **Note: This jumper should only be clipped under extenuating circumstances, as recommended by the factory.**
Not Clipped = 30°F [-1°C]. Clipped = 10°F [-12°C].
Alarm relay setting: Jumper 1 (JW1-AL2 Dry) provides field selection of the alarm relay terminal AL2 to be jumpered to 24VAC or to be a dry contact (no connection).
Not Clipped = AL2 connected to R. Clipped = AL2 dry contact (no connection).

DIP Switches - Note: In the following field configuration options, DIP switches should only be changed when power is removed from the CXM control.

DIP switch 1: Unit Performance Sentinel Disable **-** provides field selection to disable the UPS feature.
On = Enabled. Off = Disabled.
DIP switch 2: Stage 2 Selection - provides selection of whether compressor has an "on" delay. If set to stage 2, the compressor will have a 3 second delay before energizing. Also, if set for stage 2, the alarm relay will NOT cycle during test mode.
On = Stage 1. Off = Stage 2
DIP switch 3: Not Used.
DIP switch 4**:** DDC Output at EH2 - provides selection for DDC operation. If set to "DDC Output at EH2," the EH2 terminal will continuously output the last fault code of the controller. If set to "EH2 normal," EH2 will operate as standard electric heat output.
On = EH2 Normal. Off = DDC Output at EH2.
Note: Some CXM controls only have a 2 position DIP switch package. If this is the case, this option can be selected by clipping the jumper which is in position 4 of SW1.
Jumper not clipped = EH2 Normal. Jumper clipped = DDC Output at EH2.
DIP switch 5: Factory Setting - Normal position is "On."

Table 5a: LED And Alarm Relay Operations

Description of Operation	LED	Alarm
Normal Mode	ON	Open
Normal Mode w/UPS Warning	ON	Cycle (Closed 5 seconds, Open 25 seconds)
CXM is non-functional	OFF	Open
Fault Retry	Slow Flash	Open
Lockout	Fast Flash	Closed
Over/Under Voltage Shutdown	Slow Flash	Open (Closed after 15 Minutes)
Test Mode - No Fault in Memory	Flashing Code 1	Cycling Code 1
Test Mode - HP Fault in Memory	Flashing Code 2	Cycling Code 2
Test Mode - LP Fault in Memory	Flashing Code 3	Cycling Code 3
Test Mode - LT1 Fault in Memory	Flashing Code 4	Cycling Code 4
Test Mode - LT2 Fault in Memory	Flashing Code 5	Cycling Code 5
Test Mode - CO Fault in Memory	Flashing Code 6	Cycling Code 6
Test Mode - Over/Under Shutdown in Memory	Flashing Code 7	Cycling Code 7
Test Mode - UPS in Memory	Flashing Code 8	Cycling Code 8
Test Mode - Swapped Thermistor	Flashing Code 9	Cycling Code 9

Do not change selection unless instructed to do so by the factory.
-Slow Flash = 1 flash every 2 seconds
-Fast Flash = 2 flashes every 1 second
-Flash code 2 = 2 quick flashes, 10 second pause, 2 quick flashes, 10 second pause, etc.
-On pulse 1/3 second; off pulse 1/3 second

⚠ CAUTION! ⚠

CAUTION! Do not restart units without inspection and remedy of faulting condition. Equipment damage may occur.

DXM Controls

DXM Control - For detailed control information, see DXM AOM (part #97B0003N13), Lon controller AOM (part #97B0013N01) or MPC AOM (part # 97B0031N01).

Table 5b: DXM LED And Alarm Relay Operations

Description of Operation	Status LED (green)	Test LED (yellow)	Fault LED (red)	Alarm Relay
Normal mode	On	-	Off	Open
Normal mode with UPS	On	-	Flashing Code 8	Cycle (closed 5 sec, open 25 sec)
DXM is non-functional	Off	Off	Off	Open
Fault Retry	Slow Flash	-	Flashing fault code	Open
Lockout	Fast Flash	-	Flashing fault code	Closed
Test Mode	-	On	-	-
Night Setback	Flashing Code 2	-	-	-
ESD	Flashing Code 3	-	-	-
Invalid T-stat Inputs	Flashing Code 4	-	-	-
HP Fault	Slow Flash	-	Flashing Code 2	Open
LP Fault	Slow Flash	-	Flashing Code 3	Open
LT1 Fault	Slow Flash	-	Flashing Code 4	Open
LT2 Fault	Slow Flash	-	Flashing Code 5	Open
CO Fault	Slow Flash	-	Flashing Code 6	Open
Over/Under Voltages	Slow Flash	-	Flashing Code 7	Open (closed after 15 minutes)

-Slow Flash = 1 flash every 2 seconds
-Fast Flash = 2 flashes every 1 second
-Flash code 2 = 2 quick flashes, 10 second pause, 2 quick flashes, 10 second pause, etc.
-On pulse 1/3 second; off pulse 1/3 second

Field Selectable Inputs - Test mode: Test mode allows the service technician to check the operation of the control in a timely manner. By momentarily shorting the test terminals, the DXM control enters a 20 minute test mode period in which all time delays are sped up 15 times. Upon entering test mode, the status LED will flash a code representing the last fault. For diagnostic ease at the thermostat, the alarm relay will also cycle during test mode. The alarm relay will cycle on and off similar to the status LED to indicate a code representing the last fault, at the thermostat. Test mode can be exited by shorting the test terminals for 3 seconds.

Retry mode: If the control is attempting a retry of a fault, the status LED will slow flash (slow flash = one flash every 2 seconds) to indicate the control is in the process of retrying.

Field Configuration Options - Note: In the following field configuration options, jumper wires should be clipped ONLY when power is removed from the DXM control.

Water coil low temperature limit setting: Jumper 3 (JW3-LT1 Low Temp) provides field selection of temperature limit setting for LT1 of 30°F or 10°F [-1°F or -12°C] (refrigerant temperature). Not Clipped = 30°F [-1°C]. Clipped = 10°F [-12°C].
Air coil low temperature limit setting: Jumper 2 (JW2-LT2 Low Temp) provides field selection of temperature limit setting for LT2 of 30°F or 10°F [-1°F or -12°C] (refrigerant temperature). **Note: This jumper should only be clipped under extenuating circumstances, as recommended by ClimateMaster technical services.**
Not Clipped = 30°F [-1°C]. Clipped = 10°F [-12°C].
Alarm relay setting: Jumper 4 (JW4-AL2 Dry) provides field selection of the alarm relay terminal AL2 to be jumpered to 24VAC or to be a dry contact (no connection).
Not Clipped = AL2 connected to R.
Clipped = AL2 dry contact (no connection).
Low pressure normally open: Jumper 1 (JW1-LP norm open) provides field selection for low pressure input to be normally closed or normally open.
Not Clipped = LP normally closed. Clipped = LP normally open.

DIP Switches - Note: In the following field configuration options, DIP switches should only be changed when power is removed from the DXM control.

DIP Package #1 (S1) - DIP Package #1 has 8 switches and provides the following setup selections:
1.1 - Unit Performance Sentinel (UPS) disable: DIP Switch 1.1 provides field selection to disable the UPS feature. On = Enabled. Off = Disabled.
1.2 - Compressor relay staging operation: DIP 1.2 provides selection of compressor relay staging operation. The compressor relay can be selected to turn on with a stage 1 or stage 2 call from the thermostat. This is used with dual stage units (2 compressors where 2 DXM controls are being used) or with master/slave applications. In master/slave applications, each compressor and fan will stage according to its appropriate DIP 1.2 setting. If set to stage 2, the compressor will have a 3 second on-delay before energizing during a Stage 2 demand. Also, if set for stage 2, the alarm relay will NOT cycle during test mode. On = Stage 1. Off = Stage 2.
1.3 - Thermostat type (heat pump or heat/cool): DIP 1.3 provides selection of thermostat type. Heat pump or heat/cool thermostats can be selected. When in heat/cool mode, Y1 is the input call for cooling stage 1; Y2 is the input call for cooling stage 2; W1 is the input call for heating stage 1; and O/W2 is the input call for heating stage 2. In heat pump mode, Y1 is the input call for

compressor stage 1; Y2 is the input call for compressor stage 2; W1 is the input call for heating stage 3 or emergency heat; and O/W2 is the input call for reversing valve (heating or cooling, depending upon DIP 1.4).
On = Heat Pump. Off = Heat/Cool.
1.4 - Thermostat type (O/B): DIP 1.4 provides selection of thermostat type for reversing valve activation. Heat pump thermostats with "O" output (reversing valve energized for cooling) or "B" output (reversing valve energized for heating) can be selected with DIP 1.4.
On = HP stat with "O" output for cooling. Off = HP stat with "B" output for heating.
1.5 - Dehumidification mode: DIP 1.5 provides selection of normal or dehumidification fan mode. In dehumidification mode, the fan speed relay will remain off during cooling stage 2. In normal mode, the fan speed relay will turn on during cooling stage 2.
On = Normal fan mode. Off = Dehumidification mode.
1.6 - DDC output at EH2: DIP 1.6 provides selection for DDC operation. If set to "DDC Output at EH2," the EH2 terminal will continuously output the last fault code of the controller. If set to "EH2 normal," EH2 will operate as standard electric heat output.
On = EH2 Normal. Off = DDC Output at EH2.
1.7 - Boilerless operation: DIP 1.7 provides selection of boilerless operation. In boilerless mode, the compressor is only used for heating when LT1 is above the temperature specified by the setting of DIP 1.8. Below DIP 1.8 setting, the compressor is not used and the control goes into emergency heat mode, staging on EH1 and EH2 to provide heating.
On = normal. Off = Boilerless operation.
1.8 - Boilerless changeover temperature: DIP 1.8 provides selection of boilerless changeover temperature setpoint. Note that the LT1 thermistor is sensing refrigerant temperature between the coaxial heat exchanger and the expansion device (TXV). Therefore, the 50°F [10°C] setting is not 50°F [10°C] water, but approximately 60°F [16°C] EWT.
On = 50°F [10°C]. Off = 40°F [16°C].

DIP Package #2 (S2) - DIP Package #2 has 8 switches and provides the following setup selections:
2.1 - Accessory1 relay personality: DIP 2.1 provides selection of ACC1 relay personality (relay operation/ characteristics). See table 5c for description of functionality.
2.2 - Accessory1 relay personality: DIP 2.2 provides selection of ACC 1 relay personality (relay operation/ characteristics). See table 5c for description of functionality.
2.3 - Accessory1 relay personality: DIP 2.3 provides selection of ACC 1 relay options. See table 5c for description of functionality.
2.4 - Accessory2 relay personality: DIP 2.4 provides selection of ACC 2 relay personality (relay operation/ characteristics). See table5c for description of functionality.
2.5 - Accessory2 relay personality: DIP 2.5 provides selection of ACC 2 relay personality (relay operation/ characteristics). See table 5c for description of functionality.
2.6 - Accessory2 relay personality: DIP 2.6 provides selection of ACC 2 relay options. See table 5c for description of functionality.
2.7 - Auto dehumidification fan mode or high fan mode: DIP 2.7 provides selection of auto dehumidification fan mode or high fan mode. In auto dehumidification mode, the fan speed relay will remain off during cooling stage 2 IF the H input is active. In high fan mode, the fan enable and fan speed relays will turn on when the H input is active.
On = Auto dehumidification mode. Off = High fan mode.
2.8 - Special factory selection: DIP 2.8 provides special factory selection. Normal position is "On". Do not change selection unless instructed to do so by the factory.

Table 5c: Accessory DIP Switch Settings

DIP 2.1	DIP 2.2	DIP 2.3	ACC1 Relay Option
On	On	On	Cycle with fan
Off	On	On	Digital NSB
On	Off	On	Water Valve - slow opening
On	On	Off	OAD
Off	Off	Off	Reheat Option - Humidistat
Off	On	Off	Reheat Option - Dehumidistat
DIP 2.4	**DIP 2.5**	**DIP 2.6**	**ACC2 Relay Option**
On	On	On	Cycle with compressor
Off	On	On	Digital NSB
On	Off	On	Water Valve - slow opening
On	On	Off	OAD

All other DIP combinations are invalid

Safety Features - CXM and DXM Controls

Safety Features – CXM/DXM Control
The safety features below are provided to protect the compressor, heat exchangers, wiring, and other components from damage caused by operation outside of design conditions.

Anti-short cycle protection: The control features a 5 minute anti-short cycle protection for the compressor. **Note: The 5 minute anti-short cycle also occurs at power up.**
Random start: The control features a random start upon power up of 5-80 seconds.
Fault Retry: In Fault Retry mode, the Status LED begins slowly flashing to signal that the control is trying to recover from a fault input. The control will stage off the outputs and then "try again" to satisfy the thermostat input call. Once the thermostat input call is satisfied, the control will continue on as if no fault occurred. If 3 consecutive faults occur without satisfying the thermostat input call, the control will go into "lockout" mode. The last fault causing the lockout will be stored in memory and can be viewed at the "fault" LED (DXM board) or by going into test mode (CXM board). **Note: LT1/LT2 faults are factory set at only one try.**
Lockout: In lockout mode, the status LED will begin fast flashing. The compressor relay is turned off immediately. Lockout mode can be "soft" reset by turning off the thermostat (or satisfying the call). A "soft" reset keeps the fault in memory but resets the control. A "hard" reset (disconnecting power to the control) resets the control and erases fault memory.
Lockout with emergency heat: While in lockout mode, if W becomes active (CXM), emergency heat mode will occur. If DXM is configured for heat pump thermostat type (DIP 1.3), emergency heat will become active if O/W2 is energized.
High pressure switch: When the high pressure switch opens due to high refrigerant pressures, the compressor relay is de-energized immediately since the high pressure switch is in series with the compressor contactor coil. The high pressure fault recognition is immediate (does not delay for 30 continuous seconds before de-energizing the compressor).
High pressure lockout code = 2
Example: 2 quick flashes, 10 sec pause, 2 quick flashes, 10 sec. pause, etc.
Low pressure switch: The low pressure switch must be open and remain open for 30 continuous seconds during "on" cycle to be recognized as a low pressure fault. If the low pressure switch is open for 30 seconds prior to compressor power up it will be considered a low pressure (loss of charge) fault. The low pressure switch input is bypassed for the initial 120 seconds of a compressor run cycle.
Low pressure lockout code = 3
Water coil low temperature (LT1): The LT1 thermistor temperature must be below the selected low temperature limit setting for 30 continuous seconds during a compressor run cycle to be recognized as a LT1 fault. The LT1 input is bypassed for the initial 120 seconds of a compressor run cycle. LT1 is set at the factory for one try. Therefore, the control will go into lockout mode once the LT1 fault has occurred.
LT1 lockout code = 4
Air coil low temperature (LT2): The LT2 thermistor temperature must be below the selected low temperature limit setting for 30 continuous seconds during a compressor run cycle to be recognized as a LT2 fault. The LT2 input is bypassed for the initial 60 seconds of a compressor run cycle. LT2 is set at the factory for one try. Therefore, the control will go into lockout mode once the LT2 fault has occurred.
LT2 lockout code = 5
Condensate overflow: The condensate overflow sensor must sense overflow level for 30 continuous seconds to be recognized as a CO fault. Condensate overflow will be monitored at all times.
CO lockout code = 6
Over/under voltage shutdown: An over/under voltage condition exists when the control voltage is outside the range of 19VAC to 30VAC. Over/under voltage shut down is a self-resetting safety. If the voltage comes back within range for at least 0.5 seconds, normal operation is restored. This is not considered a fault or lockout. If the CXM/DXM is in over/under voltage shutdown for 15 minutes, the alarm relay will close.
Over/under voltage shut down code = 7
Unit Performance Sentinel-UPS (patent pending): The UPS feature indicates when the heat pump is operating inefficiently. A UPS condition exists when:

a. In heating mode with compressor energized, LT2 is greater than 125°F [52°C] for 30 continuous seconds, or:
b. In cooling mode with compressor energized, LT1 is greater than 125°F [52°C] for 30 continuous seconds, or:
c. In cooling mode with compressor energized, LT2 is less than 40°F [4.5°C] for 30 continuous seconds.

If a UPS condition occurs, the control will immediately go to UPS warning. The status LED will remain on as if the control is in normal mode. Outputs of the control, excluding LED and alarm relay, will NOT be affected

Safety Features - CXM and DXM Controls

by UPS. The UPS condition cannot occur during a compressor off cycle. During UPS warning, the alarm relay will cycle on and off. The cycle rate will be "on" for 5 seconds, "off" for 25 seconds, "on" for 5 seconds, "off" for 25 seconds, etc.

UPS warning code = 8

Swapped LT1/LT2 thermistors: During test mode, the control monitors to see if the LT1 and LT2 thermistors are in the appropriate places. If the control is in test mode, the control will lockout with code 9 after 30 seconds if:

a. The compressor is on in the cooling mode and the LT1 sensor is colder than the LT2 sensor, or:
b. The compressor is on in the heating mode and the LT2 sensor is colder than the LT1 sensor.

Swapped LT1/LT2 thermistor code = 9.

ESD (DXM only): The ESD (Emergency Shut Down) mode can be enabled from an external common signal to terminal ESD to shut down the unit. The green status light will flash code 3 when the unit is in ESD mode.

ESD mode = code 3 (green "status" LED)

Diagnostic Features

The LED on the CXM board advises the technician of the current status of the CXM control. The LED can display either the current CXM mode or the last fault in memory if in test mode. If there is no fault in memory, the LED will flash Code 1 (when in test mode).

The green status LED and red fault LED on the DXM board advise the technician of the current status of the DXM control. The status LED will indicate the current mode that the DXM control is in. The fault LED will ALWAYS flash a code representing the LAST fault in memory. If there is no fault in memory, the fault LED will flash Code 1. The yellow test LED will turn on when in test mode. **CAUTION: Do not restart units without inspection and remedy of faulting condition. Damage may occur.**

CXM/DXM Control Start-up Operation

The control will not operate until all inputs and safety controls are checked for normal conditions. The compressor will have a 5 minute anti-short cycle delay at power-up. The first time after power-up that there is a call for compressor, the compressor will follow a 5 to 80 second random start delay. After the random start delay and anti-short cycle delay, the compressor relay will be energized. On all subsequent compressor calls, the random start delay is omitted.

ClimaDry® Modulating Reheat Option

ClimaDry® Sequence Of Operation

A heat pump equipped with ClimaDry® can operate in three modes, cooling, cooling with reheat, and heating. The cooling/heating modes are like any other ClimateMaster WSHP. The reversing valve ("O" signal) is energized in cooling, along with the compressor contactor(s) and blower relay. In the heating mode the reversing valve is de-energized. Almost any thermostat will activate the heat pump in heating or cooling modes. The DXM microprocessor board, which is standard with the ClimaDry® option, will accept either heat pump (Y,O) thermostats or non-heat pump (Y,W) thermostats.

The reheat mode requires either a separate humidistat/ dehumidistat or a thermostat that has an integrated dehumidification function for activation. The DXM board is configured to work with either a humidistat or dehumidistat input to terminal "H" (DIP switch settings for the DXM board are shown in table 6). Upon receiving an "H" input, the DXM board will activate the cooling mode and engage reheat. Table 7 shows the relationship between thermostat input signals and unit operation.

There are four operational inputs for single stage units and six operational inputs for dual stage units:

-Fan Only
-1st Stage Cooling
-2nd Stage Cooling
-1st Stage Heating
-2nd Stage Heating
-Reheat Mode

- **Fan Only:** A (G) call from the thermostat to the (G terminal of the DXM control board will bring the unit on in fan only mode.
- **1st Stage Cooling:** A simultaneous call from (G), (Y1), and (O) to the (G), (Y1), (O/W2) terminals of the DXM control board will bring the unit on in 1st Stage Cooling.
- **2nd Stage Cooling:** A simultaneous call from (G), (Y1), (Y2), and (O) to the (G), (Y1), (Y2), and (O/W2) terminals of the DXM control board will bring the unit on in 2nd Stage Cooling. When the call is satisfied at the thermostat the unit will continue to run in 1st Stage Cooling until the 1st Stage Cooling call is removed or satisfied, shutting down the unit. **Note: Not all units have two-stage cooling functionality (e.g. GC series units).**
- **1st Stage Heating:** A simultaneous call from (G) and (Y1) to the (G) and (Y1) terminals of the DXM control board will bring the unit on in 1st Stage Heating.
- **2nd Stage Heating:** A simultaneous call from (G), (Y1), and (Y2) to the (G), (Y1), and (Y2) terminals of the DXM control board will bring the unit on in 2nd Stage Heating. When the call is satisfied at the thermostat the unit will continue to run in 1st Stage Heating until the call is removed or satisfied, shutting down the unit. NOTE: Not all units have two-stage heating functionality.
- **Reheat Mode**: A call from the Humidistat/ Dehumidistat to the (H) terminal of the DXM control board will bring the unit on in Reheat Mode if there is no call for cooling at the thermostat. When the Humidistat Dehumidification call is removed or satisfied the unit will shut down. Note: Cooling always overrides Reheat Mode. In the Cooling mode, the unit cools and dehumidifies. If the cooling thermostat is satisfied but there is still a call for dehumidification, the unit will continue to operate in Reheat Mode.

ClimaDry® Component Functions

The ClimaDry® option consists of the following components:

- Proportional Controller
- Supply Air Sensor
- Motorized Valve
- Loop Pump
- Hydronic Coil

The Proportional Controller operates on 24 VAC power supply and automatically adjusts the water valve based upon the Supply Air Sensor. The Supply Air Sensor senses supply air temperature at the blower inlet providing the input signal necessary for the proportional control to drive the motorized valve during the reheat mode of operation. The Motorized Valve is a proportional actuator/three-way valve combination used to divert the condenser water from the coax to the hydronic reheat coil during the reheat mode of operation. The proportional controller sends a signal to the motorized valve based on the supply air temperature of the supply air sensor.

The Loop Pump circulates condenser water through the hydronic reheat coil during the reheat mode of operation. In this application, the loop pump is only energized during the reheat mode of operation. The Hydronic Coil is utilized during the reheat mode of operation to reheat the air to the setpoint of the proportional controller. Condenser water is diverted by the motorized valve and pumped through the hydronic coil by the loop pump in proportion to the control setpoint. The amount of reheating is dependent on the setpoint and how far from setpoint the supply air temperature is. The factory setpoint is 72°F [22.2°C], generally considered "neutral" air.

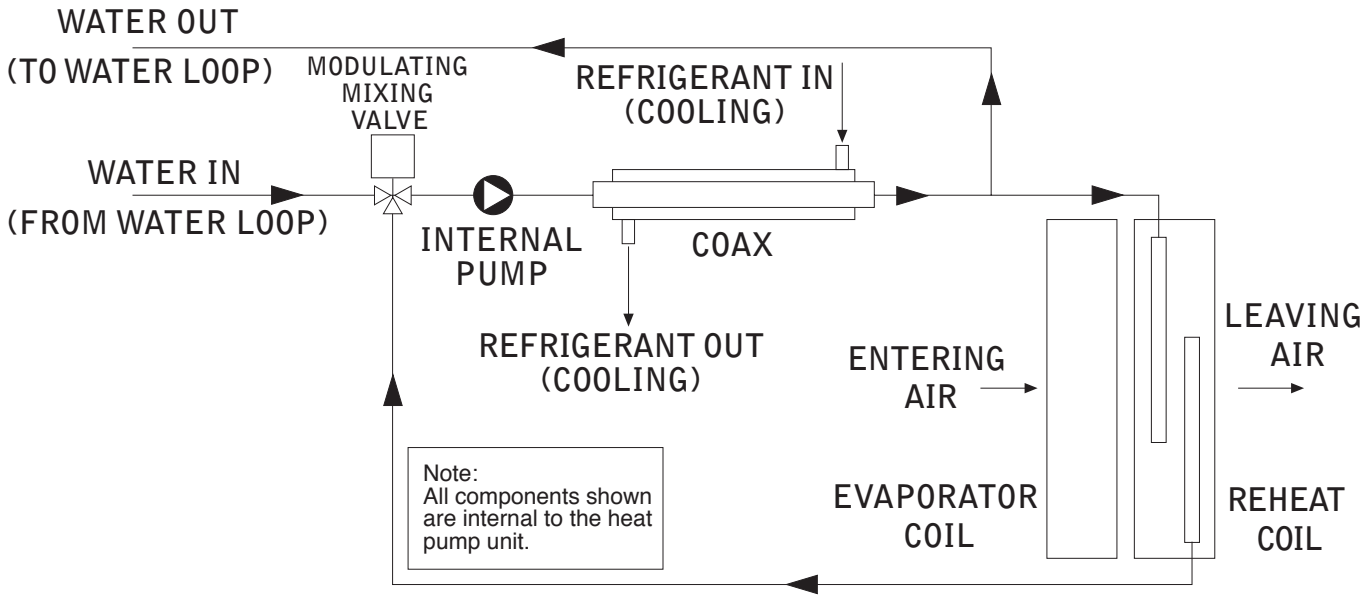
ClimaDry® Modulating Reheat Option

ClimaDry® Application Considerations
Unlike most hot gas reheat options, the ClimaDry® option will operate over a wide range of EWTs. Special flow regulation (water regulating valve) is not required for low EWT conditions. However, below 55°F [13°C], supply air temperatures may not be maintained at 72°F [22°C] because the cooling capacity exceeds the reheat coil capacity at low water temperatures. Below 55°F [13°C], essentially all water is diverted to the reheat coil (no heat of rejection to the building loop). Although the ClimaDry® option will work fine with low EWTs, overcooling of the space may result with well water systems or on rare occasions with ground loop (geothermal) systems **(Note: Extended range units are required for well water and ground loop systems).** Since dehumidification is generally only required in cooling, most ground loop systems will not experience overcooling of the supply air temperature. If overcooling of the space is a concern (e.g. computer room well water application), auxiliary heating may be required to maintain space temperature when the unit is operating in the dehumidification mode.

Water-source heat pumps with ClimaDry® should not be used as make-up air units. These applications should use equipment specifically designed for makeup air.

Unit minimum entering air temperature while in the dehumidification, cooling, or continuous fan modes is **65ºF DB/55ºF WB**. Operation below this minimum may result in nuisance faults.

Figure 24: ClimaDry® Schematic



ClimaDry® Modulating Reheat Option

Table 6: Humidistat/Dehumidistat Logic & DXM (2.1, 2.2., 2.3) DIP Settings

Sensor	2.1	2.2	2.3	Logic	Reheat (ON) - H	Reheat (OFF) - H
Humidistat	OFF	OFF	OFF	Reverse	0 VAC	24 VAC
Dehumidistat	OFF	ON	OFF	Standard	24 VAC	0 VAC

Table 7: ClimaDry® Operating Modes

Mode	Input					Output				
	O	G	Y1	Y2[3]	H	O	G	Y1	Y2[3]	Reheat
No Demand	ON/OFF	OFF	OFF	OFF	OFF	ON/OFF	OFF	OFF	OFF	OFF
Fan Only	ON/OFF	ON	OFF	OFF	OFF	ON/OFF	ON	OFF	OFF	OFF
Cooling 1st Stage	ON	ON	ON	OFF	OFF	ON	ON	ON	OFF	OFF
Cooling 2nd Stage	ON	ON	ON	ON	OFF	ON	ON	ON	ON	OFF
Cooling & Dehumidistat[1]	ON	ON	ON	ON/OFF	ON	ON	ON	ON	ON/OFF	OFF
Dehumidistat Only	ON/OFF	OFF	OFF	OFF	ON	ON	ON	ON	ON	ON
Heating 1st Stage	OFF	ON	ON	OFF	OFF	OFF	ON	ON	OFF	OFF
Heating 2nd Stage	OFF	ON	ON	ON	OFF	OFF	ON	ON	ON	OFF
Heating & Dehumidistat[2]	OFF	ON	ON	ON/OFF	ON	OFF	ON	ON	ON/OFF	OFF

[1]Cooling input takes priority over dehumidify input.
[2]DXM is programmed to ignore the H demand when the unit is in heating mode.
[3]N/A for single stage units; Full load operation for dual capacity units.
[4]ON/OFF = Either ON or OFF.

UNIT STARTING AND OPERATING CONDITIONS

Operating Limits

Environment – Units are designed for indoor installation only. Never install units in areas subject to freezing or where humidity levels could cause cabinet condensation (such as unconditioned spaces subject to 100% outside air).

Power Supply – A voltage variation of +/– 10% of nameplate utilization voltage is acceptable.

Determination of operating limits is dependent primarily upon three factors: 1) return air temperature. 2) water temperature, and 3) ambient temperature. When any one of these factors is at minimum or maximum levels, the other two factors should be at normal levels to ensure proper unit operation. Extreme variations in temperature and humidity and/or corrosive water or air will adversely affect unit performance, reliability, and service life. Consult Table 8a for operating limits.

Table 8a: Operating Limits

Operating Limits	TS	
	Cooling	Heating
Air Limits		
Min. ambient air, DB	45ºF [7ºC]	39ºF [4ºC]
Rated ambient air, DB	80.6ºF [27ºC]	68ºF [20ºC]
Max. ambient air, DB	130ºF [54.4ºC]	85ºF [29ºC]
Min. entering air, DB/WB	*60/50ºF [16/10ºC]	45ºF [7ºC]
Rated entering air, DB/WB	80.6/66.2ºF [27/19ºC]	68ºF [20ºC]
Max. entering air, DB/WB	95/75ºF [35/24ºC]	80ºF [27ºC]
Water Limits		
Min. entering water	30ºF [-1ºC]	20ºF [-6.7ºC]
Normal entering water	50-110ºF [10-43ºC]	30-70ºF [-1 to 21ºC]
Max. entering water	120ºF [49ºC]	90ºF [32ºC]
Normal Water Flow	1.5 to 3.0 gpm / ton [1.6 to 3.2 l/m per kW]	

***If with ClimaDry® 65/55ºF (18/13ºC)**

Commissioning Conditions

Consult Table 8b for the particular model. Starting conditions vary depending upon model and are based upon the following notes:

Notes:

1. Conditions in Table 8b are not normal or continuous operating conditions. Minimum/maximum limits are start-up conditions to bring the building space up to occupancy temperatures. Units are not designed to operate under these conditions on a regular basis.
2. Voltage utilization range complies with AHRI Standard 110.

Table 8b: Building Commissioning Limits

Commissioning Limits	Cooling	Heating
Air Limits		
Min. ambient air, DB	45ºF [7ºC]	39ºF [4ºC]
Rated ambient air, DB	80.6ºF [27ºC]	68ºF [20ºC]
Max. ambient air, DB	130ºF [54.4ºC]	85ºF [29ºC]
Min. entering air, DB/WB	*50/45ºF [10/7ºC]	40ºF [4.5ºC]
Rated entering air, DB/WB	80.6/66.2ºF [27/19ºC]	68ºF [20ºC]
Max. entering air, DB/WB	110/83ºF [43/28ºC]	80ºF [27ºC]
Water Limits		
Min. entering water	30ºF [-1ºC]	20ºF [-6.7ºC]
Normal entering water	50-110ºF [10-43ºC]	30-70ºF [-1 to 21ºC]
Max. entering water	120ºF [49ºC]	90ºF [32ºC]
Normal Water Flow	1.5 to 3.0 gpm / ton [1.6 to 3.2 l/m per kW]	

***If with ClimaDry® 65/55ºF (18/13ºC)**

Piping System Cleaning and Flushing

Piping System Cleaning and Flushing - Cleaning and flushing the WLHP piping system is the single most important step to ensure proper start-up and continued efficient operation of the system.

Follow the instructions below to properly clean and flush the system:

1. Ensure that electrical power to the unit is disconnected.
2. Install the system with the supply hose connected directly to the return riser valve. Use a single length of flexible hose.
3. Open all air vents. Fill the system with water. DO NOT allow system to overflow. Bleed all air from the system. Pressurize and check the system for leaks and repair as appropriate. ClimaDry®-equipped units have a manual air bleed valve at the top of the reheat coil. This valve must be used to bleed the air from the reheat coil after filling the system, for ClimaDry® to operate properly.
4. Verify that all strainers are in place (ClimateMaster recommends a strainer with a #20 stainless steel wire mesh). Start the pumps, and systematically check each vent to ensure that all air is bled from the system.
5. Verify that make-up water is available. Adjust make-up water as required to replace the air which was bled from the system. Check and adjust the water/air level in the expansion tank.
6. Set the boiler to raise the loop temperature to approximately 85°F [29°C]. Open a drain at the lowest point in the system. Adjust the make-up water replacement rate to equal the rate of bleed.
7. Refill the system and add trisodium phosphate in a proportion of approximately one pound per 150 gallons (.8 kg per 1000 l) of water (or other equivalent approved cleaning agent). Reset the boiler to raise the loop temperature to 100°F [38°C]. Circulate the solution for a minimum of 8 to 24 hours. At the end of this period, shut off the circulating pump and drain the solution. Repeat system cleaning if desired.
8. When the cleaning process is complete, remove the short-circuited hoses. Reconnect the hoses to the proper supply, and return the connections to each of the units. Refill the system and bleed off all air.
9. Test the system pH with litmus paper. The system water should be in the range of pH 6.0 - 8.5 (see table 3). Add chemicals, as appropriate to maintain neutral pH levels.
10. When the system is successfully cleaned, flushed, refilled and bled, check the main system panels, safety cutouts and alarms. Set the controls to properly maintain loop temperatures.

⚠ CAUTION! ⚠

CAUTION! DO NOT use “Stop Leak” or similar chemical agent in this system. Addition of chemicals of this type to the loop water will foul the heat exchanger and inhibit unit operation.

Note: The manufacturer strongly recommends all piping connections, both internal and external to the unit, be pressure tested by an appropriate method prior to any finishing of the interior space or before access to all connections is limited. Test pressure may not exceed the maximum allowable pressure for the unit and all components within the water system. The manufacturer will not be responsible or liable for damages from water leaks due to inadequate or lack of a pressurized leak test, or damages caused by exceeding the maximum pressure rating during installation.

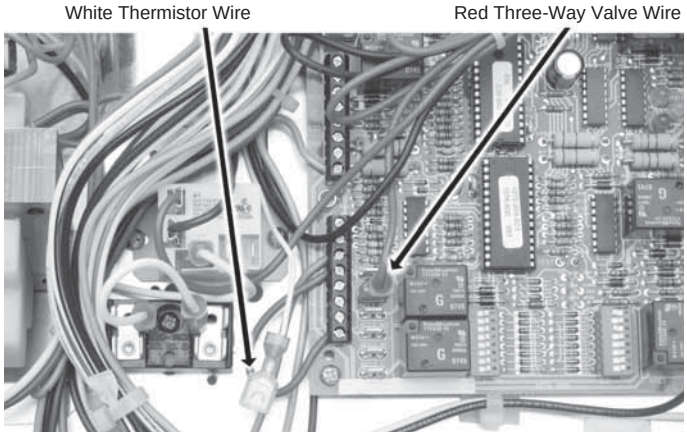
Flushing/Purging Units with ClimaDry®

When flushing/purging units equipped with ClimaDry® the unit should be fully flushed/purged before attempting to flush/purge the ClimaDry® coil. Once the unit is flushed, energize the modulating three-way dehumidification valve to allow flow through the ClimaDry® hydronic circuit.

The unit must be powered (but not operating) during flushing/purging. Unit power is required to operate the three-way modulating valve during flushing.

Disable the ClimaDry® sensor located in the supply air stream by removing the white wire from the low voltage terminal block (LVTB) as shown in the figure that follows. Energize the modulating three-way dehumidification valve by removing the red wire from the ACC1 'N.O.' terminal on the DXM board. Connect this wire to the ACC1 'NC' terminal of the DXM controller, as shown in figure 1, to energize the modulating three-way dehumidification valve. Once energized, the valve will take 45 – 75 seconds to fully shift. Continue flushing during this time. After the valve has completed its shift, use the air bleed from the top of the reheat coil to purge air from the coil.

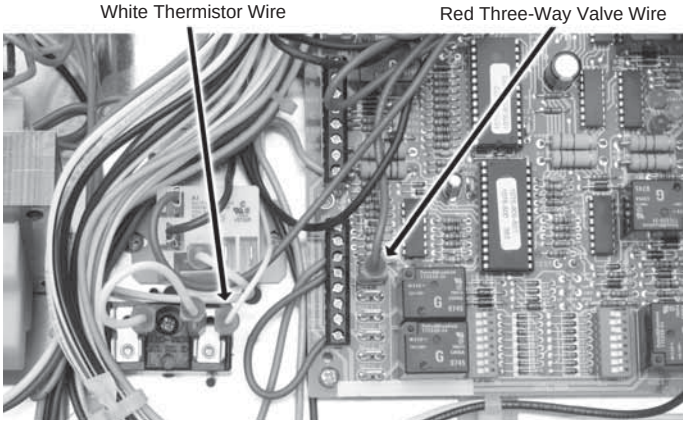
Flushing/Purging Wiring



De-energize the valve by removing the red wire from the ACC1 'NC' terminal on the DXM board. The valve will spring return to its normal position in just a few seconds. After the valve has fully returned, repeat the process of running the valve through its cycle and purging air from the reheat coil.

Under extreme circumstances this procedure may be required multiple times to purge all air from the circuit. After completing the flushing/purging procedure, reconnect the red wire to the ACC1 'N.O.' terminal on the DXM for normal operation. Reconnect the white sensor wire to the LVTB, as shown below. If air is allowed to collect in the ClimaDry® piping, nuisance trips may occur. Additional flush/purge cycles may be used when required.

Normal Unit Wiring



Unit and System Checkout

⚠ WARNING! ⚠

WARNING! Polyolester Oil, commonly known as POE oil, is a synthetic oil used in many refrigeration systems including those with HFC-410A refrigerant. POE oil, if it ever comes in contact with PVC or CPVC piping, may cause failure of the PVC/CPVC. PVC/CPVC piping should never be used as supply or return water piping with water source heat pump products containing HFC-410A as system failures and property damage may result.

Unit and System Checkout

BEFORE POWERING SYSTEM, please check the following:

UNIT CHECKOUT

- ❑ Balancing/shutoff valves: Ensure that all isolation valves are open and water control valves are wired.
- ❑ Line voltage and wiring: Verify that voltage is within an acceptable range for the unit and wiring and fuses/breakers are properly sized. Verify that low voltage wiring is complete.
- ❑ Unit control transformer: Ensure that transformer has the properly selected voltage tap.
- ❑ Entering water and air: Ensure that entering water and air temperatures are within operating limits of Table 8a-b.
- ❑ Low water temperature cutout: Verify that low water temperature cut-out on the CXM/DXM control is properly set.
- ❑ Unit fan: Manually rotate fan to verify free rotation and ensure that blower wheel is secured to the motor shaft. Be sure to remove any shipping supports if needed. DO NOT oil motors upon start-up. Fan motors are pre-oiled at the factory. Check unit fan speed selection and compare to design requirements.
- ❑ Condensate line: Verify that condensate line is open and properly pitched toward drain.
- ❑ Water flow balancing: Record inlet and outlet water temperatures for each heat pump upon startup. This check can eliminate nuisance trip outs and high velocity water flow that could erode heat exchangers.
- ❑ Unit air coil and filters: Ensure that filter is clean and accessible. Clean air coil of all manufacturing oils.
- ❑ Unit controls: Verify that CXM or DXM field selection options are properly set.

SYSTEM CHECKOUT

- ❑ System water temperature: Check water temperature for proper range and also verify heating and cooling setpoints for proper operation.
- ❑ System pH: Check and adjust water pH if necessary to maintain a level between 6 and 8.5. Proper pH promotes longevity of hoses and fittings (see table 3).
- ❑ System flushing: Verify that all hoses are connected end to end when flushing to ensure that debris bypasses the unit heat exchanger, water valves and other components. Water used in the system must be potable quality initially and clean of dirt, piping slag, and strong chemical cleaning agents. Verify that all air is purged from the system. Air in the system can cause poor operation or system corrosion.
- ❑ Cooling tower/boiler: Check equipment for proper setpoints and operation.
- ❑ Standby pumps: Verify that the standby pump is properly installed and in operating condition.
- ❑ System controls: Verify that system controls function and operate in the proper sequence.
- ❑ Low water temperature cutout: Verify that low water temperature cut-out controls are provided for the outdoor portion of the loop. Otherwise, operating problems may occur.
- ❑ System control center: Verify that the control center and alarm panel have appropriate setpoints and are operating as designed.
- ❑ Miscellaneous: Note any questionable aspects of the installation.

⚠ CAUTION! ⚠

CAUTION! Verify that ALL water control valves are open and allow water flow prior to engaging the compressor. Freezing of the coax or water lines can permanently damage the heat pump.

⚠ CAUTION! ⚠

CAUTION! To avoid equipment damage, DO NOT leave system filled in a building without heat during the winter unless antifreeze is added to the water loop. Heat exchangers never fully drain by themselves and will freeze unless winterized with antifreeze.

NOTICE! Failure to remove shipping brackets from spring-mounted compressors will cause excessive noise, and could cause component failure due to added vibration.

Unit Start-Up Procedure

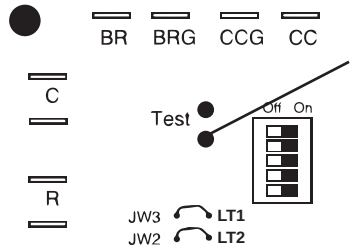
Unit Start-up Procedure

1. Turn the thermostat fan position to "ON". Blower should start.
2. Balance air flow at registers.
3. Adjust all valves to their full open positions. Turn on the line power to all heat pumps.
4. Room temperature should be within the minimum-maximum ranges of table 8a-b. During start-up checks, loop water temperature entering the heat pump should be between 60°F [16°C] and 95°F [35°C].
5. Two factors determine the operating limits of ClimateMaster heat pumps, (a) return air temperature, and (b) water temperature. When any one of these factors is at a minimum or maximum level, the other factor must be at normal level to ensure proper unit operation.
   a. Adjust the unit thermostat to the warmest setting. Place the thermostat mode switch in the "COOL" position. Slowly reduce thermostat setting until the compressor activates.
   b. Check for cool air delivery at the unit grille within a few minutes after the unit has begun to operate. **Note: Units have a five minute time delay in the control circuit that can be eliminated on the CXM/DXM control board as shown in Figure 25. See controls description for details.**
   c. Verify that the compressor is on and that the water flow rate is correct by measuring pressure drop through the heat exchanger using the P/T plugs and comparing to table 9.
   d. Check the elevation and cleanliness of the condensate lines. Dripping may be a sign of a blocked line. Check that the condensate trap is filled to provide a water seal.
   e. Refer to table 12. Check the temperature of both entering and leaving water. If temperature is within range, proceed with the test. Verify correct water flow by comparing unit pressure drop across the heat exchanger versus the data in table 9. Heat of rejection (HR) can be calculated and compared to submittal data capacity pages. The formula for HR for systems with water is as follows: HR (Btuh) = TD x GPM x 500,where TD is the temperature difference between the entering and leaving water, and GPM is the flow rate in U.S. GPM, determined by comparing the pressure drop across the heat exchanger to table 9. In S-I units, the formula is as follows: HR (kW) = TD x l/s x 4.18.
   f. Check air temperature drop across the air coil when compressor is operating. Air temperature drop should be between 15°F and 25°F [8°C and 14°C].
   g. Turn thermostat to "OFF" position. A hissing noise indicates proper functioning of the reversing valve.
6. Allow five (5) minutes between tests for pressure to equalize before beginning heating test.
   a. Adjust the thermostat to the lowest setting. Place the thermostat mode switch in the "HEAT" position.
   b. Slowly raise the thermostat to a higher temperature until the compressor activates.
   c. Check for warm air delivery within a few minutes after the unit has begun to operate.
   d. Refer to table 12. Check the temperature of both entering and leaving water. If temperature is within range, proceed with the test. If temperature is outside of the operating range, check refrigerant pressures and compare to table 11. Verify correct water flow by comparing unit pressure drop across the heat exchanger versus the data in table 9. Heat of extraction (HE) can be calculated and compared to submittal data capacity pages. The formula for HE for systems with water is as follows: HE (kW) = TD xGPM x 500, where TD is the temperature difference between the entering and leaving water, and l/s is the flow rate in U.S. GPM, determined by comparing the pressure drop across the heat exchanger to table 9. In S-I units, the formula is as follows: HE (kW) = TD x l/s x 4.18.
   e. Check air temperature rise across the air coil when compressor is operating. Air temperature rise should be between 20°F and 30°F [11°C and 17°C].
   f. Check for vibration, noise, and water leaks.
7. If unit fails to operate, perform troubleshooting analysis (see troubleshooting section). If the check described fails to reveal the problem and the unit still does not operate, contact a trained service technician to ensure proper diagnosis and repair of the equipment.
8. When testing is complete, set system to maintain desired comfort level.

Note: If performance during any mode appears abnormal, refer to the CXM/DXM section or troubleshooting section of this manual. To obtain maximum performance, the air coil should be cleaned before start-up. A 10% solution of dishwasher detergent and water is recommended.

Unit Start-Up Procedure

Figure 25: Test Mode Pins



Short test pins together to enter Test Mode and speed-up timing and delays for 20 minutes.

⚠ WARNING! ⚠

WARNING! When the disconnect switch is closed, high voltage is present in some areas of the electrical panel. Exercise caution when working with energized equipment.

⚠ CAUTION! ⚠

CAUTION! Verify that ALL water control valves are open and allow water flow prior to engaging the compressor. Freezing of the coax or water lines can permanently damage the heat pump.

Tranquility® 20 (TS) Series
Rev.:02/05/14

Unit Operating Conditions

Table 9: TS Coax Water Pressure Drop

Model	U.S. GPM	l/s	l/m	Pressure Drop, psi [kPa]*			
				30ºF [-1ºC]	50ºF [10ºC]	70ºF [21ºC]	90ºF [32ºC]
006	1.0	0.063	4	0.3 [2.1]	0.3 [2.1]	0.2 [1.4]	0.2 [1.4]
	1.5	0.095	6	1.6 [11.0]	1.4 [11.0]	1.2 [11.0]	1.0 [11.0]
	2.0	0.126	8	3.0 [20.7]	2.6 [17.9]	2.2 [15.2]	1.8 [12.4]
009	1.4	0.088	5	0.8 [5.5]	0.7 [4.8]	0.6 [4.1]	0.6 [4.1]
	2.1	0.132	8	1.5 [10.3]	1.4 [9.7]	1.2 [8.3]	1.1 [7.6]
	2.8	0.177	11	2.7 [18.6]	2.4 [16.5]	2.2 [15.2]	1.9 [13.1]
012	1.8	0.114	7	0.6 [4.1]	0.5 [3.4]	0.4 [2.8]	0.3 [2.1]
	2.6	0.164	10	2.1 [14.5]	1.9 [13.1]	1.6 [11.0]	1.4 [9.7]
	3.5	0.221	13	3.8 [26.2]	3.4 [23.4]	3.0 [20.7]	2.6 [17.9]
018	2.8	0.176	11	0.7 [4.8]	0.5 [3.4]	0.3 [2.1]	0.2[1.4]
	4.1	0.258	15	2.1 [14.5]	1.7 [11.7]	1.4 [9.7]	1.1 [7.6]
	5.5	0.347	21	3.5 [24.1]	2.8 [19.3]	2.4 [16.6]	2.0 [13.8]
024	3.0	0.189	11	1.2 [8.0]	0.3 [2.4]	0.2 [1.1	0.1 [.69]
	4.5	0.284	17	1.9 [13.2]	1.0 [7.2]	0.7 [4.7]	0.5 [3.4]
	6.0	0.379	23	2.0 [13.8]	1.4 [9.7]	1.2 [7.8]	1.0 [6.8]
030	3.8	0.240	14	0.9 [5.9]	0.8 [5.6]	0.8 [5.2]	0.7 [5.0]
	5.6	0.353	21	1.6 [11.0]	1.4 [9.7]	1.3 [9.2]	1.3 [8.8]
	7.5	0.473	28	2.5 [17.5]	2.2 [15.2]	2.1 [14.3]	2.0 [13.7]
036	4.5	0.284	17	1.2 [8.0]	0.8 [5.6]	0.9 [6.1]	0.8 [5.6]
	6.8	0.430	26	2.4 [16.5]	1.9 [13.4]	1.8 [12.4]	1.7 [11.6]
	9.0	0.568	34	4.0 [27.6]	3.2 [22.2]	3.0 [20.6]	2.8 [19.4]
042	5.5	0.347	21	1.0 [7.0]	0.9 [6.1]	0.8 [5.8]	0.8 [5.6]
	8.3	0.524	31	2.2 [15.2]	1.9 [12.8]	1.8 [12.3]	1.8 [12.4]
	11.0	0.694	42	3.8 [25.8]	3.4 [23.1]	3.2 [22.1]	3.1 [21.4
048	6.0	0.379	23	1.1 [7.6]	0.9 [5.9]	0.7 [5.2]	0.8 [5.4]
	9.0	0.568	34	2.3 [15.9]	1.8 [12.5]	1.8 [12.7]	1.8 [12.3]
	12.0	0.757	45	3.9 [26.9]	3.2 [22.0]	3.2 [21.9]	3.0 [21.0]
060	7.5	0.473	28	1.3 [9.1]	0.6 [4.3]	0.5 [3.2]	0.5 [3.4]
	11.3	0.713	43	3.5 [24.5]	2.5 [16.9]	2.1 [14.2]	2.0 [13.6]
	15.0	0.947	57	6.1 [42.0]	4.7 [32.4]	4.1 [28.2]	3.9 [27.0]
070	9.0	0.568	34	2.7 [18.7]	1.7 [12.0]	1.5 [10.4]	1.6 [10.7]
	13.5	0.852	51	5.2 [35.8]	3.8 [26.3]	3.3 [22.8]	3.2 [22.2]
	18.0	1.140	68	8.1 [56.0]	6.4 [44.1]	5.7 [39.0]	5.5 [37.6]

Motorized Water Valve Option Corrections

Model	Cv	MOPD	WPD Adders		
			GPM	PSI	FT
006	4.9	150	1.0	0.04	0.10
	4.9	150	1.5	0.09	0.22
	4.9	150	2.0	0.17	0.38
009	4.9	150	1.4	0.08	0.19
	4.9	150	2.1	0.18	0.42
	4.9	150	2.8	0.33	0.75
012	4.9	150	1.8	0.13	0.31
	4.9	150	2.6	0.28	0.65
	4.9	150	3.5	0.51	1.18
018	10.3	125	2.8	0.07	0.16
	10.3	125	4.1	0.16	0.37
	10.3	125	5.5	0.29	0.66
024	10.3	125	4.0	0.15	0.35
	10.3	125	6.0	0.34	0.78
	10.3	125	8.0	0.60	1.39
030	10.3	125	4.0	0.15	0.35
	10.3	125	6.0	0.34	0.78
	10.3	125	8.0	0.60	1.39
036	10.3	125	4.5	0.19	0.44
	10.3	125	6.8	0.43	0.99
	10.3	125	9.0	0.76	1.76
042	10.3	125	5.5	0.29	0.66
	10.3	125	8.3	0.64	1.48
	10.3	125	11.0	1.14	2.63
048	10.3	125	6.0	0.34	0.78
	10.3	125	9.0	0.76	1.76
	10.3	125	12.0	1.36	3.14
060	8.9	125	7.5	0.71	1.64
	8.9	125	11.3	1.60	3.69
	8.9	125	15.0	2.84	6.56
070	8.9	125	8.3	0.86	1.98
	8.9	125	12.4	1.93	4.47
	8.9	125	16.5	3.44	7.94

ClimaDry® II Option Corrections (When Operating in Non-ClimaDry® Mode)

Model	WPD Adders		
	GPM	PSI	FT
018	2.8	0.77	1.77
	4.1	1.65	3.80
024	4.0	1.57	3.62
	6.0	3.53	8.14
030	4.0	0.69	1.59
	6.0	1.55	3.58
036	4.5	0.87	2.02
	6.8	1.99	4.60
042	5.5	1.30	3.01
	8.3	6.75	15.58
048	6.0	1.55	3.58
	9.0	3.49	8.06
060	7.5	1.49	3.45
	11.3	3.39	7.82
070	8.3	1.83	4.22
	12.4	4.08	9.42

Unit Operating Conditions

Table 11: TS Series Typical Unit Operating Pressures and Temperatures (60Hz - I-P Units)

006		Full Load Cooling						Full Load Heating					
Entering Water Temp °F	Water Flow GPM/ton	Suction Pressure PSIG	Discharge Pressure PSIG	Superheat	Subcooling	Water Temp Drop °F	Air Temp Rise °F DB	Suction Pressure PSIG	Discharge Pressure PSIG	Superheat	Sub cooling	Water Temp Drop °F	Air Temp Rise °F DB
30*	1.5	114-124	142-162	24-29	3-8	15.2-17.2	17-23	75-85	272-292	13-18	4-9	5.9-7.9	16-22
	2.25	111-121	132-152	26-31	3-8	11.4-13.4	17-23	78-88	274-294	13-18	4-9	4.3-6.3	16-22
	3	109-119	122-142	28-33	3-8	7.5-9.5	17-23	81-91	276-296	13-18	4-9	2.7-4.7	17-23
50	1.5	130-140	190-210	14-19	2-7	16.5-18.5	18-24	104-114	299-319	12-17	6-11	8.8-10.8	21-27
	2.25	129-139	180-200	16-21	2-7	12.3-14.3	18-24	112-122	304-324	12-17	4-9	6.7-8.7	22-28
	3	128-138	170-190	19-24	2-7	8-10	18-24	120-130	308-328	12-17	3-8	4.5-6.5	23-29
70	1.5	143-153	265-285	9-14	2-7	15.5-17.5	18-24	129-139	321-341	11-16	7-12	11.2-13.2	25-31
	2.25	141-151	252-272	10-15	2-7	11.5-13.5	18-24	144-154	330-350	13-18	4-9	8.8-10.8	27-33
	3	140-150	240-260	11-16	2-7	7.5-9.5	18-24	159-169	340-360	15-20	3-8	6.3-8.3	28-34
90	1.5	149-159	340-370	8-13	2-7	14.2-16.2	17-23	163-173	349-369	13-18	7-12	14.3-16.3	30-36
	2.25	149-159	335-355	8-13	2-7	10.6-12.6	17-23	180-190	360-380	11-16	4-9	11.2-13.2	32-38
	3	148-158	320-340	8-13	2-7	7-9	17-23	198-208	372-392	10-15	3-8	8.1-10.1	34-40
110	1.5	154-164	451-471	8-13	2-7	12.7-14.7	15-21						
	2.25	154-164	428-448	8-13	2-7	9.5-11.5	15-21						
	3	153-163	405-425	8-13	2-7	6.5-8.5	15-21						

*Based on 15% Methanol antifreeze solution

009		Full Load Cooling						Full Load Heating					
Entering Water Temp °F	Water Flow GPM/ton	Suction Pressure PSIG	Discharge Pressure PSIG	Superheat	Subcooling	Water Temp Drop °F	Air Temp Rise °F DB	Suction Pressure PSIG	Discharge Pressure PSIG	Superheat	Sub cooling	Water Temp Drop °F	Air Temp Rise °F DB
30*	1.5	126-136	161-181	17-22	8-13	19.8-21.8	21-27	74-84	278-298	6-11	4-9	6.1-8.1	18-24
	2.25	126-136	146-166	17-22	7-12	14.9-16.9	21-27	77-87	280-300	6-11	4-9	4.5-6.5	18-24
	3	126-136	131-151	17-22	6-11	9.9-11.9	21-27	79-89	283-303	6-11	3-8	2.8-4.8	19-25
50	1.5	132-142	215-235	10-15	8-13	18.8-20.8	20-26	104-114	309-329	8-12	7-12	9.6-11.6	24-30
	2.25	132-142	200-220	10-15	7-12	14.1-16.1	20-26	106-116	312-332	8-12	7-12	7-9	24-30
	3	132-142	185-205	10-15	6-11	9.4-11.4	20-26	108-118	315-335	8-12	7-12	4.5-6.5	25-31
70	1.5	138-148	278-298	8-13	9-14	17.7-19.7	19-25	127-137	332-352	10-15	10-15	12-14	29-35
	2.25	138-148	263-283	8-13	8-13	13.1-15.1	19-25	132-142	340-360	11-16	10-15	9-10	29-35
	3	137-147	248-268	8-13	7-12	8.5-10.5	19-25	138-148	347-367	13-18	10-15	6.1-8.1	30-36
90	1.5	142-152	365-385	8-13	9-14	16-18	18-24	164-174	372-392	17-22	13-18	14.5-16.5	35-41
	2.25	142-152	351-371	8-13	8-13	12-14	18-24	165-175	375-395	18-23	13-18	11.2-13.2	35-41
	3	142-152	337-357	8-13	7-12	8-10	18-24	167-177	379-399	19-24	13-18	7.9-9.9	36-42
110	1.5	150-160	439-459	7-12	9-14	14.2-16.2	17-23						
	2.25	150-160	439-459	7-12	8-13	10.6-12.6	17-23						
	3	150-160	439-459	7-12	7-12	6.9-8.9	17-23						

*Based on 15% Methanol antifreeze solution

012		Full Load Cooling						Full Load Heating					
Entering Water Temp °F	Water Flow GPM/ton	Suction Pressure PSIG	Discharge Pressure PSIG	Superheat	Subcooling	Water Temp Drop °F	Air Temp Rise °F DB	Suction Pressure PSIG	Discharge Pressure PSIG	Superheat	Sub cooling	Water Temp Drop °F	Air Temp Rise °F DB
30*	1.5	98-108	140-160	36-41	14-19	17.1-19.1	19-25	72-82	301-321	9-14	12-17	6.5-8.5	21-27
	2.25	98-108	135-155	36-41	12-17	12.5-14.5	19-25	85-95	304-324	9-14	12-17	4.7-6.7	21-27
	3	99-109	127-148	36-41	10-15	7.9-9.9	19-25	78-88	308-328	9-14	12-17	2.9-4.9	22-28
50	1.5	118-128	215-235	22-27	14-19	18.1-20.1	20-26	100-110	337-357	10-15	15-20	9.5-11.5	26-32
	2.25	118-128	200-220	22-27	12-17	13.1-15.1	20-26	98-108	334-354	10-15	15-20	6.6-8.6	26-32
	3	118-128	185-205	22-27	10-15	8.1-10.1	19-25	95-105	332-352	11-16	15-20	3.8-5.8	26-32
70	1.5	132-142	300-320	11-16	12-17	17-19	19-25	115-125	361-381	19-24	18-23	11.1-13.1	29-35
	2.25	132-142	263-282	11-16	10-15	12.6-14.6	19-25	112-122	360-380	20-25	18-23	8-10	29-35
	3	132-142	245-265	12-17	7-12	8.2-10.2	19-25	110-120	356-376	21-26	18-23	4.8-6.8	29-35
90	1.5	138-148	366-386	9-14	11-16	15.8-17.8	18-24	122-132	376-396	34-39	22-27	12.1-14.1	32-38
	2.25	138-148	353-373	9-14	9-14	14.9-16.9	18-24	123-133	378-398	36-41	22-27	9-11	32-38
	3	138-148	340-360	9-14	6-11	14-16	18-24	124-134	380-400	38-43	23-28	5.8-7.8	32-38
110	1.5	145-155	453-473	9-14	9-14	14.7-16.7	16-22						
	2.25	145-155	442-462	9-14	7-12	10.8-12.8	16-22						
	3	145-155	431-451	9-14	5-10	6.8-8.8	17-23						

*Based on 15% Methanol antifreeze solution

Unit Operating Conditions

Table 11: TS Series Typical Unit Operating Pressures and Temperatures: Continued

018		Full Load Cooling - without HWG active						Full Load Heating - without HWG active					
Entering Water Temp °F	Water Flow GPM/ton	Suction Pressure PSIG	Discharge Pressure PSIG	Superheat	Subcooling	Water Temp Rise °F	Air Temp Drop °F DB	Suction Pressure PSIG	Discharge Pressure PSIG	Superheat	Subcooling	Water Temp Drop °F	Air Temp Rise °F DB
30*	1.5	120-130	155-175	27-32	11-16	16.9-19.9	16-22	73-83	268-288	8-13	4-9	6.1-8.1	15-21
	2.25	120-130	142-162	27-32	9-14	12.5-14.5	17-23	75-85	270-290	8-13	4-9	4.4-6.4	16-22
	3	120-130	128-148	27-32	9-14	8.1-10.1	17-23	78-88	272-292	8-13	4-9	2.9-4.9	16-22
50	1.5	137-147	220-240	16-21	10-15	17-19	16-22	102-112	295-315	8-13	8-13	9.1-11.1	20-26
	2.25	137-147	206-226	16-21	8-13	12.6-14.6	17-23	106-116	297-317	8-13	8-13	6.9-8.9	21-27
	3	137-147	192-212	16-21	8-13	8.4-10.4	17-23	110-120	299-319	8-13	8-13	4.7-6.7	21-27
70	1.5	142-152	287-307	7-12	10-15	15.9-17.9	16-22	131-141	324-344	9-14	10-15	12.1-14.1	25-33
	2.25	142-152	273-239	7-12	8-13	11.8-13.8	17-23	137-147	326-346	9-14	10-15	9.3-11.3	26-34
	3	142-152	259-279	7-12	8-13	7.8-9.8	17-23	144-154	328-348	9-14	10-15	6.6-8.6	26-34
90	1.5	146-156	375-395	6-11	10-15	14.9-16.9	16-22	174-184	360-380	10-15	12-17	15.8-17.8	32-40
	2.25	146-156	361-381	6-11	8-13	11-13	17-23	180-190	367-387	11-16	12-17	11.9-13.9	33-41
	3	146-156	347-367	6-11	8-13	7.2-9.2	17-23	187-197	374-394	12-17	12-17	8-10	33-41
110	1.5	154-164	478-498	6-11	10-15	14-16	16-22						
	2.25	154-164	461-481	6-11	8-13	10.2-12.2	16-22						
	3	154-164	445-465	6-11	8-13	6.5-8.5	16-22						

*Based on 15% Methanol antifreeze solution

024		Full Load Cooling - without HWG active						Full Load Heating - without HWG active					
Entering Water Temp °F	Water Flow GPM/ton	Suction Pressure PSIG	Discharge Pressure PSIG	Superheat	Subcooling	Water Temp Rise °F	Air Temp Drop °F DB	Suction Pressure PSIG	Discharge Pressure PSIG	Superheat	Subcooling	Water Temp Drop °F	Air Temp Rise °F DB
30*	1.5	115-125	154-174	40-45	8-13	16.5-18.5	19-25	73-83	283-303	8-12	6-11	5.9-7.9	16-22
	2.25	115-125	141-161	40-45	6-11	12.1-14.1	20-26	75-85	285-305	8-12	6-11	4.2-6.2	17-23
	3	115-125	127-147	40-45	6-11	77.7-9.7	20-26	78-88	287-307	8-12	6-11	2.7-4.7	18-24
50	1.5	115-120	209-229	24-29	10-15	15.7-17.7	18-24	102-112	313-333	8-12	8-13	8.9-10.9	22-28
	2.25	115-120	195-215	24-29	8-13	11.6-13.6	18-24	106-116	314-334	8-12	8-13	6.7-8.7	23-29
	3	115-120	181-201	24-29	8-13	7.6-9.6	18-24	110-120	316-336	8-12	8-13	4.5-6.5	23-29
70	1.5	136-146	275-295	6-11	6-11	15.7-17.7	18-24	128-138	340-360	9-14	9-14	11.3-13.3	27-34
	2.25	136-146	261-281	6-11	5-10	11.6-13.6	18-24	134-144	342-362	9-14	9-14	8.5-10.5	28-35
	3	136-146	247-267	6-11	4-9	7.6-9.6	18-24	141-151	344-364	9-14	9-14	5.8-7.8	28-35
90	1.5	140-150	361-381	6-11	6-11	14.9-16.9	18-24	162-172	370-390	14-19	9-14	14.4-16.4	32-40
	2.25	140-150	347-367	6-11	5-10	11-13	18-24	166-176	376-396	15-20	9-14	10.8-12.8	34-42
	3	140-150	333-353	6-11	4-9	7.2-9.2	18-24	171-181	383-403	16-21	9-14	7.1-9.1	34-42
110	1.5	144-154	460-480	6-11	6-11	13.9-15.9	17-23						
	2.25	144-154	445-465	6-11	4-9	10.2-12.2	17-23						
	3	144-154	428-448	6-11	4-9	6.5-8.5	17-23						

*Based on 15% Methanol antifreeze solution

030		Full Load Cooling - without HWG active						Full Load Heating - without HWG active					
Entering Water Temp °F	Water Flow GPM/ton	Suction Pressure PSIG	Discharge Pressure PSIG	Superheat	Subcooling	Water Temp Rise °F	Air Temp Drop °F DB	Suction Pressure PSIG	Discharge Pressure PSIG	Superheat	Subcooling	Water Temp Drop °F	Air Temp Rise °F DB
30*	1.5	116-126	146-166	27-32	7-13	19.6-21.6	16-22	69-79	275-295	7-12	6-11	7.2-9.2	16-22
	2.25	115-125	138-158	27-32	6-11	14.3-16.3	17-23	73-83	277-297	7-12	6-11	5.4-7.4	17-23
	3	115-125	128-148	27-32	6-11	8-10	17-23	76-86	279-299	7-12	6-11	3.5-5.5	17-23
50	1.5	129-139	217-237	12-17	6-11	20.8-22.8	17-23	96-106	300-320	10-15	9-14	10.5-12.5	21-27
	2.25	128-138	203-223	12-17	5-10	15-17	18-24	100-110	304-324	10-15	9-14	7.6-9.6	22-28
	3	128-138	189-209	12-17	5-10	9.2-11.2	18-24	105-115	309-329	10-15	9-14	4.8-6.8	22-28
70	1.5	132-142	293-313	9-14	6-11	20.1-22.1	17-23	123-133	327-347	11-16	11-16	13.2-15.2	25-32
	2.25	131-141	274-294	9-14	5-10	14.4-16.4	18-24	129-139	333-353	11-16	11-16	9.8-11.8	26-33
	3	131-141	256-276	9-14	5-10	8.6-10.6	18-24	135-145	339-359	11-16	11-16	6.4-8.4	27-34
90	1.5	137-147	383-403	7-12	5-10	19.4-21.4	16-22	155-165	355-375	13-18	11-16	16.8-18.8	30-38
	2.25	137-147	362-382	7-12	5-10	13.8-15.8	16-22	162-172	362-382	14-19	11-16	12.7-14.7	31-39
	3	137-147	342-362	7-12	5-10	8.2-10.2	16-22	169-179	369-389	16-21	11-16	8.6-10.6	32-40
110	1.5	143-153	475-495	6-11	9-14	18.2-20.2	16-22						
	2.25	143-153	457-477	6-11	6-11	13-14	16-22						
	3	143-153	439-459	6-11	6-11	7.7-9.7	16-22						

*Based on 15% Methanol antifreeze solution

Unit Operating Conditions

Table 11: TS Series Typical Unit Operating Pressures and Temperatures: Continued

036		Full Load Cooling - without HWG active						Full Load Heating - without HWG active					
Entering Water Temp °F	Water Flow GPM/ton	Suction Pressure PSIG	Discharge Pressure PSIG	Superheat	Subcooling	Water Temp Rise °F	Air Temp Drop °F DB	Suction Pressure PSIG	Discharge Pressure PSIG	Superheat	Subcooling	Water Temp Drop °F	Air Temp Rise °F DB
30*	**1.5**	117-127	142-162	33-38	8-14	19.1-21.1	15-22	69-79	276-296	10-15	10-15	7.2-9.2	17-23
	2.25	116-126	134-154	33-38	7-12	13.8-15.8	15-22	73-83	278-298	10-15	10-15	5.3-7.3	18-24
	3	116-126	124-144	33-38	7-12	7.4-9.4	15-22	76-86	280-300	10-15	10-15	3.5-5.5	18-24
50	**1.5**	136-146	211-231	11-16	6-11	20.6-22.6	17-23	99-109	302-322	10-15	13-18	10.6-12.6	22-28
	2.25	136-146	197-217	11-16	5-10	14.8-16.8	17-23	103-113	306-326	10-15	13-18	7.7-9.7	23-29
	3	136-146	183-203	11-16	5-10	9-11	17-23	108-118	311-331	10-15	13-18	5-7	23-29
70	**1.5**	137-147	275-295	9-14	10-15	19-21	18-24	127-137	332-352	10-15	15-20	13.5-15.5	27-34
	2.25	137-147	260-280	9-14	9-14	13.8-15.8	19-25	133-143	338-358	10-15	15-20	10.1-12.1	28-35
	3	137-147	245-265	9-14	9-14	8-10	19-25	139-149	344-364	10-15	15-20	6.7-8.7	29-36
90	**1.5**	142-152	373-393	7-12	10-15	19.5-21.5	17-23	164-174	365-385	11-16	15-20	17.4-19.4	34-42
	2.25	142-152	352-372	8-13	6-11	13.9-15.9	17-23	172-182	372-392	11-16	15-20	13.2-15.2	35-43
	3	142-152	332-352	8-13	6-11	8.3-10.3	17-23	181-191	379-399	12-17	15-20	9-11	36-44
110	**1.5**	147-157	467-487	6-11	10-15	16.2-18.2	16-22						
	2.25	147-157	448-468	6-11	8-13	11.9-13.9	16-22						
	3	147-157	430-450	6-11	7-12	7.6-9.6	16-22						

*Based on 15% Methanol antifreeze solution

042		Full Load Cooling - without HWG active						Full Load Heating - without HWG active					
Entering Water Temp °F	Water Flow GPM/ton	Suction Pressure PSIG	Discharge Pressure PSIG	Superheat	Subcooling	Water Temp Rise °F	Air Temp Drop °F DB	Suction Pressure PSIG	Discharge Pressure PSIG	Superheat	Subcooling	Water Temp Drop °F	Air Temp Rise °F DB
30*	1.5	114-124	170-190	27-32	10-15	17.2-19.2	17-23	69-79	286-306	5-10	5-10	4.5-6.5	16-22
	2.25	113-123	150-170	27-32	9-14	12.7-14.7	17-23	72-82	289-309	5-10	6-11	3.9-5.9	17-23
	3	113-123	131-151	27-32	7-12	8.2-10.2	17-23	75-85	292-312	6-11	6-11	3.2-5.2	18-24
50	1.5	130-140	226-246	10-15	6-11	17.8-19.8	20-26	100-110	315-335	7-12	6-11	9-11	22-28
	2.25	129-139	208-228	10-15	5-10	13.3-15.3	20-26	105-115	322-342	8-13	6-11	7-9	23-29
	3	129-139	190-210	10-15	4-9	8.8-10.8	20-26	110-120	330-350	10-15	7-12	5-7	24-30
70	1.5	132-142	290-310	6-11	6-11	17.3-19.3	19-25	131-141	347-367	11-16	6-11	13.4-15.4	29-35
	2.25	131-141	273-293	6-11	5-10	12.8-14.8	19-25	138-148	358-378	13-18	8-13	10-12	30-36
	3	131-141	255-275	6-11	4-9	8.3-10.3	19-25	145-155	369-389	16-21	9-14	6.9-8.9	31-37
90	1.5	136-146	370-390	6-11	6-11	16-18	17-23	175-185	393-413	19-24	7-12	17.6-19.6	36-42
	2.25	135-145	350-370	6-11	5-10	11.8-13.8	17-23	177-187	401-421	20-25	9-14	13.2-15.2	37-43
	3	135-145	330-350	6-11	4-9	7.6-9.6	17-23	180-190	409-429	22-27	12-17	8.7-10.7	38-44
110	1.5	143-153	469-489	6-11	6-11	14-16	16-22						
	2.25	142-152	448-468	6-11	5-10	11-13	16-22						
	3	141-151	427-447	6-11	4-9	7-9	16-22						

*Based on 15% Methanol antifreeze solution

048		Full Load Cooling - without HWG active						Full Load Heating - without HWG active					
Entering Water Temp °F	Water Flow GPM/ton	Suction Pressure PSIG	Discharge Pressure PSIG	Superheat	Subcooling	Water Temp Rise °F	Air Temp Drop °F DB	Suction Pressure PSIG	Discharge Pressure PSIG	Superheat	Subcooling	Water Temp Drop °F	Air Temp Rise °F DB
30*	**1.5**	108-118	180-200	27-32	12-17	19.8-21.8	19-25	65-75	293-313	7-12	9-14	8.2-10.2	17-23
	2.25	107-117	161-181	28-33	10-15	14.8-16.8	19-25	68-78	297-217	8-13	9-14	6.2-8.2	18-24
	3	107-117	142-162	29-34	9-14	9.8-11.8	19-25	72-82	301-321	9-14	9-14	4.2-6.2	19-25
50	**1.5**	123-133	236-256	16-21	8-13	20.2-22.2	21-27	92-102	321-341	10-15	11-16	11.6-13.6	23-29
	2.25	122-132	218-238	17-22	7-12	15.2-18.2	21-27	100-110	330-350	11-16	11-16	8.9-10.9	24-30
	3	122-132	200-220	17-22	6-11	10.2-12.2	21-27	108-118	340-360	12-17	11-16	6-8	26-32
70	**1.5**	130-140	305-325	10-15	8-13	20-22	20-26	122-132	353-373	12-17	11-16	15-17	29-35
	2.25	129-139	285-305	11-16	6-11	15-17	20-26	133-143	365-385	14-19	11-16	11.5-13.5	31-37
	3	129-139	265-285	11-16	5-10	10-12	20-26	144-154	378-398	16-21	11-16	8-10	33-39
90	**1.5**	133-143	390-410	8-13	8-13	19-21	19-25	166-176	397-417	16-21	9-14	19.5-21.5	37-43
	2.25	132-142	368-388	9-14	6-11	14-16	19-25	173-183	407-727	18-23	9-14	14.7-16.7	38-44
	3	132-142	345-365	9-14	5-10	9-11	19-25	181-191	417-437	19-24	10-15	9.9-11.9	40-46
110	**1.5**	141-151	497-517	6-11	8-13	18-20	18-24						
	2.25	140-150	472-492	7-12	6-11	13.5-15.5	18-24						
	3	140-150	447-467	8-13	5-10	8.7-10.7	18-24						

*Based on 15% Methanol antifreeze solution

Unit Operating Conditions

Table 11: TS Series Typical Unit Operating Pressures and Temperatures: Continued

060		Full Load Cooling - without HWG active						Full Load Heating - without HWG active					
Entering Water Temp °F	Water Flow GPM/ton	Suction Pressure PSIG	Discharge Pressure PSIG	Superheat	Subcooling	Water Temp Rise °F	Air Temp Drop °F DB	Suction Pressure PSIG	Discharge Pressure PSIG	Superheat	Subcooling	Water Temp Drop °F	Air Temp Rise °F DB
30*	1.5	98-108	160-180	40-45	12-17	20-22	19-25	62-72	276-296	6-11	6-11	8-10	17-23
	2.25	97-107	149-169	41-46	12-17	14.3-16.3	19-25	66-76	280-300	6-11	6-11	6-8	18-24
	3	96-106	137-157	42-48	11-16	8.5-10.5	20-26	70-80	284-304	7-12	6-11	4-6	19-25
50	1.5	118-128	225-245	36-41	11-16	21.2-23.2	19-25	88-98	306-326	10-15	8-13	11-13	23-29
	2.25	117-127	210-230	37-42	10-15	15.7-17.7	20-26	94-104	311-331	10-15	8-13	8.3-10.3	24-30
	3	115-125	195-215	38-43	9-14	10.2-12.2	21-27	100-110	317-337	11-16	9-14	5.5-7.5	25-31
70	1.5	135-145	300-320	12-17	9-14	20.3-22.3	21-27	112-122	333-353	12-17	10-15	14-16	28-34
	2.25	133-143	285-305	14-19	8-13	15-17	21-27	122-132	342-362	14-19	10-15	10.5-12.5	30-36
	3	132-142	270-290	16-21	7-12	10-12	22-28	130-140	351-371	15-20	11-16	7.3-9.3	32-38
90	1.5	139-149	390-410	8-13	7-12	19.3-21.3	20-26	147-157	369-389	15-20	10-15	17.7-19.7	36-42
	2.25	138-148	370-390	8-13	6-11	14.3-16.3	21-27	154-164	377-397	18-23	10-15	13.4-15.4	37-43
	3	138-148	350-370	8-13	6-11	9.3-11.3	21-27	160-170	385-405	19-24	11-16	9-11	38-44
110	1.5	144-154	488-508	8-13	8-13	18.4-20.4	21-27						
	2.25	143-153	468-488	7-12	6-11	13.6-15.6	21-27						
	3	142-152	448-468	7-12	5-10	8.8-10.8	21-27						

*Based on 15% Methanol antifreeze solution

070		Full Load Cooling - without HWG active						Full Load Heating - without HWG active					
Entering Water Temp °F	Water Flow GPM/ton	Suction Pressure PSIG	Discharge Pressure PSIG	Superheat	Subcooling	Water Temp Rise °F	Air Temp Drop °F DB	Suction Pressure PSIG	Discharge Pressure PSIG	Superheat	Subcooling	Water Temp Drop °F	Air Temp Rise °F DB
30*	1.5	110-120	177-197	36-41	15-20	20.2-22.2	21-27	61-71	290-310	12-18	9-14	8-10	19-25
	2.25	109-119	162-182	37-42	13-18	15-17	21-27	65-75	292-312	12-18	10-15	6-8	20-26
	3	107-117	147-167	38-43	11-16	9.7-11.7	22-28	68-78	296-316	12-18	10-15	4-6	21-27
50	1.5	128-138	246-266	18-23	11-16	21-23	22-28	88-98	320-340	11-17	13-18	11.7-13.7	26-32
	2.25	128-138	228-248	19-24	9-14	15.6-17.6	23-29	96-106	330-350	11-17	11-16	9-11	27-33
	3	127-137	210-230	20-25	6-11	10.2-12.2	24-30	105-115	338-358	11-17	9-14	6-8	29-35
70	1.5	134-144	305-325	9-14	11-16	20.8-22.8	23-29	118-128	355-375	10-16	14-19	15.2-17.2	33-39
	2.25	133-143	289-309	9-14	9-14	15.4-17.4	23-29	130-140	368-388	12-18	13-18	11.7-13.7	35-41
	3	131-141	273-293	9-14	6-11	10-12	23-29	141-151	380-400	15-21	11-16	8-10	37-43
90	1.5	140-150	390-410	10-15	11-16	19.6-21.6	22-28	158-168	401-421	9-15	13-18	19.5-21.5	41-47
	2.25	139-149	373-393	10-15	9-14	14.5-16.5	22-28	168-178	412-432	10-16	12-17	14.8-16.8	43-49
	3	138-148	355-375	10-15	6-11	9.3-11.3	22-28	178-188	423-443	12-18	12-17	10-12	45-51
110	1.5	144-154	488-508	10-15	9-14	18.4-20.4	20-27						
	2.25	143-153	468-488	10-15	6-11	13.6-15.6	20-27						
	3	142-152	448-468	9-14	5-10	8.8-10.8	20-27						

*Based on 15% Methanol antifreeze solution

Table 12: Water Temperature Change Through Heat Exchanger

Water Flow, gpm [l/m]	Rise, Cooling °F, [°C]	Drop, Heating °F, [°C]
For Closed Loop: Ground Source or Closed Loop Systems at 3 gpm per ton [3.2 l/m per kW]	9 - 12 [5 - 6.7]	4 - 9 [2.2 - 5]
For Open Loop: Ground Water Systems at 1.5 gpm per ton [1.6 l/m per kW]	18 - 26 [9.9 - 14.4]	7 - 19 [3.9 - 10.5]

Preventive Maintenance

Water Coil Maintenance - (Direct ground water applications only) If the system is installed in an area with a known high mineral content (125 P.P.M. or greater) in the water, it is best to establish a periodic maintenance schedule with the owner so the coil can be checked regularly. Consult the well water applications section of this manual for a more detailed water coil material selection. Should periodic coil cleaning be necessary, use standard coil cleaning procedures, which are compatible with the heat exchanger material and copper water lines. Generally, the more water flowing through the unit, the less chance for scaling. Therefore, 1.5 gpm per ton [1.6 l/m per kW] is recommended as a minimum flow. Minimum flow rate for entering water temperatures below 50°F [10°C] is 2.0 gpm per ton [2.2 l/m per kW].

Water Coil Maintenance - (All other water loop applications) Generally water coil maintenance is not needed for closed loop systems. However, if the piping is known to have high dirt or debris content, it is best to establish a periodic maintenance schedule with the owner so the water coil can be checked regularly. Dirty installations are typically the result of deterioration of iron or galvanized piping or components in the system. Open cooling towers requiring heavy chemical treatment and mineral buildup through water use can also contribute to higher maintenance. Should periodic coil cleaning be necessary, use standard coil cleaning procedures, which are compatible with both the heat exchanger material and copper water lines. Generally, the more water flowing through the unit, the less chance for scaling. However, flow rates over 3 gpm per ton (3.9 l/m per kW) can produce water (or debris) velocities that can erode the heat exchanger wall and ultimately produce leaks.

Hot Water Generator Coils - See water coil maintenance for ground water units. If the potable water is hard or not chemically softened, the high temperatures of the desuperheater will tend to scale even quicker than the water coil and may need more frequent inspections. In areas with extremely hard water, a HWG is not recommended.

Filters - Filters must be clean to obtain maximum performance. Filters should be inspected every month under normal operating conditions and be replaced when necessary. Units should never be operated without a filter.

Washable, high efficiency, electrostatic filters, when dirty, can exhibit a very high pressure drop for the fan motor and reduce air flow, resulting in poor performance. It is especially important to provide consistent washing of these filters (in the opposite direction of the normal air flow) once per month using a high pressure wash similar to those found at self-serve car washes.

Condensate Drain - In areas where airborne bacteria may produce a “slimy” substance in the drain pan, it may be necessary to treat the drain pan chemically with an algaecide approximately every three months to minimize the problem. The condensate pan may also need to be cleaned periodically to ensure indoor air quality. The condensate drain can pick up lint and dirt, especially with dirty filters. Inspect the drain twice a year to avoid the possibility of plugging and eventual overflow.

Compressor - Conduct annual amperage checks to ensure that amp draw is no more than 10% greater than indicated on the serial plate data.

Fan Motors - All units have lubricated fan motors. Fan motors should never be lubricated unless obvious, dry operation is suspected. Periodic maintenance oiling is not recommended, as it will result in dirt accumulating in the excess oil and cause eventual motor failure. Conduct annual dry operation check and amperage check to ensure amp draw is no more than 10% greater than indicated on serial plate data.

Air Coil - The air coil must be cleaned to obtain maximum performance. Check once a year under normal operating conditions and, if dirty, brush or vacuum clean. Care must be taken not to damage the aluminum fins while cleaning. CAUTION: Fin edges are sharp.

Cabinet - Do not allow water to stay in contact with the cabinet for long periods of time to prevent corrosion of the cabinet sheet metal. Generally, vertical cabinets are set up from the floor a few inches [7 - 8 cm] to prevent water from entering the cabinet. The cabinet can be cleaned using a mild detergent.

Refrigerant System - To maintain sealed circuit integrity, do not install service gauges unless unit operation appears abnormal. Reference the operating charts for pressures and temperatures. Verify that air and water flow rates are at proper levels before servicing the refrigerant circuit.

Functional Troubleshooting

Fault	Htg	Clg	Possible Cause	Solution
Main power problems	X	X	Green Status LED Off	Check line voltage circuit breaker and disconnect.
				Check for line voltage between L1 and L2 on the contactor.
				Check for 24VAC between R and C on CXM/DXM'
				Check primary/secondary voltage on transformer.
HP Fault Code 2 **High Pressure**		X	Reduced or no water flow in cooling	Check pump operation or valve operation/setting.
				Check water flow adjust to proper flow rate.
		X	Water Temperature out of range in cooling	Bring water temp within design parameters.
	X		Reduced or no air flow in heating	Check for dirty air filter and clean or replace.
				Check fan motor operation and airflow restrictions.
				Dirty Air Coil- construction dust etc.
				Too high of external static. Check static vs blower table.
	X		Air temperature out of range in heating	Bring return air temp within design parameters.
	X	X	Overcharged with refrigerant	Check superheat/subcooling vs typical operating condition table.
	X	X	Bad HP Switch	Check switch continuity and operation. Replace.
LP/LOC Fault Code 3 **Low Pressure / Loss of Charge**	X	X	Insufficient charge	Check for refrigerant leaks
	X		Compressor pump down at start-up	Check charge and start-up water flow.
LT1 Fault Code 4 **Water coil low temperature limit**	X		Reduced or no water flow in heating	Check pump operation or water valve operation/setting.
				Plugged strainer or filter. Clean or replace..
				Check water flow adjust to proper flow rate.
	X		Inadequate antifreeze level	Check antifreeze density with hydrometer.
	X		Improper temperature limit setting (30°F vs 10°F [-1°C vs -2°C])	Clip JW3 jumper for antifreeze (10°F [-12°C]) use.
	X		Water Temperature out of range	Bring water temp within design parameters.
	X	X	Bad thermistor	Check temp and impedance correlation per chart
LT2 Fault Code 5 **Air coil low temperature limit**		X	Reduced or no air flow in cooling	Check for dirty air filter and clean or replace.
				Check fan motor operation and airflow restrictions.
				Too high of external static. Check static vs blower table.
		X	Air Temperature out of range	Too much cold vent air? Bring entering air temp within design parameters.
		X	Improper temperature limit setting (30°F vs 10°F [-1°C vs -12°C])	Normal airside applications will require 30°F [-1°C] only.
	X	X	Bad thermistor	Check temp and impedance correlation per chart.
Condensate Fault Code 6	X	X	Blocked drain	Check for blockage and clean drain.
	X	X	Improper trap	Check trap dimensions and location ahead of vent.
		X	Poor drainage	Check for piping slope away from unit.
				Check slope of unit toward outlet.
				Poor venting. Check vent location.
		X	Moisture on sensor	Check for moisture shorting to air coil.
	X	X	Plugged air filter	Replace air filter.
	x	X	Restricted Return Air Flow	Find and eliminate restriction. Increase return duct and/or grille size.
Over/Under Voltage Code 7 **(Auto resetting)**	X	X	Under Voltage	Check power supply and 24VAC voltage before and during operation.
				Check power supply wire size.
				Check compressor starting. Need hard start kit?
				Check 24VAC and unit transformer tap for correct power supply voltage.
	X	X	Over Voltage	Check power supply voltage and 24VAC before and during operation.
				Check 24VAC and unit transformer tap for correct power supply voltage.
Unit Performance Sentinel Code 8	X		Heating mode LT2>125°F [52°C]	Check for poor air flow or overcharged unit.
		X	Cooling Mode LT1>125°F [52°C] OR LT2< 40ºF [4ºC])	Check for poor water flow, or air flow.
Swapped Thermistor Code 9	X	X	LT1 and LT2 swapped	Reverse position of thermistors
No Fault Code Shown	X	X	No compressor operation	See "Only Fan Operates".
	X	X	Compressor overload	Check and replace if necessary.
	X	X	Control board	Reset power and check operation.
Unit Short Cycles	X	X	Dirty air filter	Check and clean air filter.
	X	X	Unit in "test mode"	Reset power or wait 20 minutes for auto exit.
	X	X	Unit selection	Unit may be oversized for space. Check sizing for actual load of space.
	X	X	Compressor overload	Check and replace if necessary
Only Fan Runs	X	X	Thermostat position	Ensure thermostat set for heating or cooling operation.
	X	X	Unit locked out	Check for lockout codes. Reset power.
	X	X	Compressor Overload	Check compressor overload. Replace if necessary.
	X	X	Thermostat wiring	Check thermostat wiring at heat pump. Jumper Y and R for compressor operation in test mode.
Only Compressor Runs	X	X	Thermostat wiring	Check G wiring at heat pump. Jumper G and R for fan operation
	X	X	Fan motor relay	Jumper G and R for fan operation. Check for Line voltage across BR contacts.
	X	X		Check fan power enable relay operation (if present).
	X	X	Fan motor	Check for line voltage at motor. Check capacitor.
	X	X	Thermostat wiring	Check thermostat wiring at heat pump. Jumper Y and R for compressor operation in test mode
Unit Doesn't Operate in Cooling		X	Reversing valve	Set for cooling demand and check 24VAC on RV coil and at CXM/DXM board.
				If RV is stuck, run high pressure up by reducing water flow and while operating engage and disengage RV coil voltage to push valve.
		X	Thermostat setup	Check for 'O' RV setup not 'B'.
		X	Thermostat wiring	Check O wiring at heat pump. Jumper O and R for RV coil 'click'.
		X	Thermostat wiring	Put thermostat in cooling mode. Check 24 VAC on O (check between C and O); check for 24 VAC on W (check between W and C). There should be voltage on O, but not on W. If voltage is present on W, thermostat may be bad or wired incorrectly.

Performance Troubleshooting

Performance Troubleshooting	Htg	Clg	Possible Cause	Solution
Insufficient capacity/ Not cooling or heating	X	X	Dirty filter	Replace or clean.
	X		Reduced or no air flow in heating	Check for dirty air filter and clean or replace.
				Check fan motor operation and airflow restrictions.
				Too high of external static. Check static vs. blower table.
		X	Reduced or no air flow in cooling	Check for dirty air filter and clean or replace.
				Check fan motor operation and airflow restrictions.
				Too high of external static. Check static vs. blower table.
	X	X	Leaky duct work	Check supply and return air temperatures at the unit and at distant duct registers if significantly different, duct leaks are present.
	X	X	Low refrigerant charge	Check superheat and subcooling per chart.
	X	X	Restricted metering device	Check superheat and subcooling per chart. Replace.
		X	Defective reversing valve	Perform RV touch test.
	X	X	Thermostat improperly located	Check location and for air drafts behind stat.
	X	X	Unit undersized	Recheck loads & sizing. Check sensible clg. load and heat pump capacity.
	X	X	Scaling in water heat exchanger	Perform scaling check and clean if necessary.
	X	X	Inlet water too hot or too cold	Check load, loop sizing, loop backfill, ground moisture.
High Head Pressure	X		Reduced or no air flow in heating	Check for dirty air filter and clean or replace.
				Check fan motor operation and air flow restrictions.
				Too high of external static. Check static vs. blower table.
		X	Reduced or no water flow in cooling	Check pump operation or valve operation/setting.
				Check water flow. Adjust to proper flow rate.
		X	Inlet water too hot	Check load, loop sizing, loop backfill, ground moisture.
	X		Air temperature out of range in heating	Bring return air temperature within design parameters.
		X	Scaling in water heat exchanger	Perform scaling check and clean if necessary.
	X	X	Unit overcharged	Check superheat and subcooling. Re-weigh in charge.
	X	X	Non-condensables in system	Vacuum system and re-weigh in charge.
	X	X	Restricted metering device.	Check superheat and subcooling per chart. Replace.
Low Suction Pressure	X		Reduced water flow in heating.	Check pump operation or water valve operation/setting.
				Plugged strainer or filter. Clean or replace.
				Check water flow. Adjust to proper flow rate.
	X		Water temperature out of range.	Bring water temperature within design parameters.
		X	Reduced air flow in cooling.	Check for dirty air filter and clean or replace.
				Check fan motor operation and air flow restrictions.
				Too high of external static. Check static vs. blower table.
		X	Air temperature out of range	Too much cold vent air? Bring entering air temperature within design parameters.
	X	X	Insufficient charge	Check for refrigerant leaks.
Low Discharge Air Temperature in Heating	X		Too high of air flow	Check fan motor speed selection and air flow chart.
	X		Poor performance	See 'Insufficient Capacity'
High humidity		X	Too high of air flow	Check fan motor speed selection and airflow chart.
		X	Unit oversized	Recheck loads & sizing. Check sensible clg load and heat pump capacity.

Tranquility® 20 (TS) Series
Rev.:02/05/14

Start-Up Log Sheet

Installer: Complete unit and system checkout and follow unit start-up procedures in the IOM. Use this form to record unit information, temperatures and pressures during start-up. Keep this form for future reference.

Job Name: _____ **Street Address:** _____

Model Number: _____ **Serial Number:** _____

Unit Location in Building: _____

Date: _____ **Sales Order No:** _____

In order to minimize troubleshooting and costly system failures, complete the following checks and data entries before the system is put into full operation.

Fan Motor: Speed Tap (PSC) or CFM Settings (ECM)_____

Temperatures: F or C **Antifreeze:** _____%

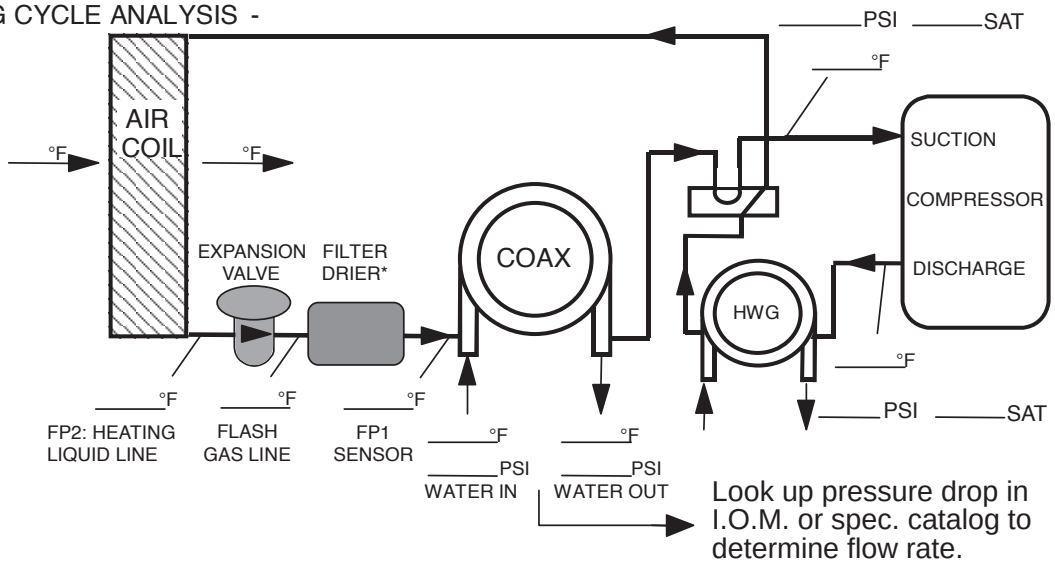
Pressures: PSIG or kPa **Type** _____

	Cooling Mode		Heating Mode
Entering Fluid Temperature			
Leaving Fluid Temperature			
Temperature Differential			
Return-Air Temperature	DB	WB	DB
Supply-Air Temperature	DB	WB	DB
Temperature Differential			
Water Coil Heat Exchanger (Water Pressure IN)			
Water Coil Heat Exchanger (Water Pressure OUT)			
Pressure Differential			
Water Flow GPM			
Compressor			
Amps			
Volts			
Discharge Line Temperature			
Motor			
Amps			
Volts			

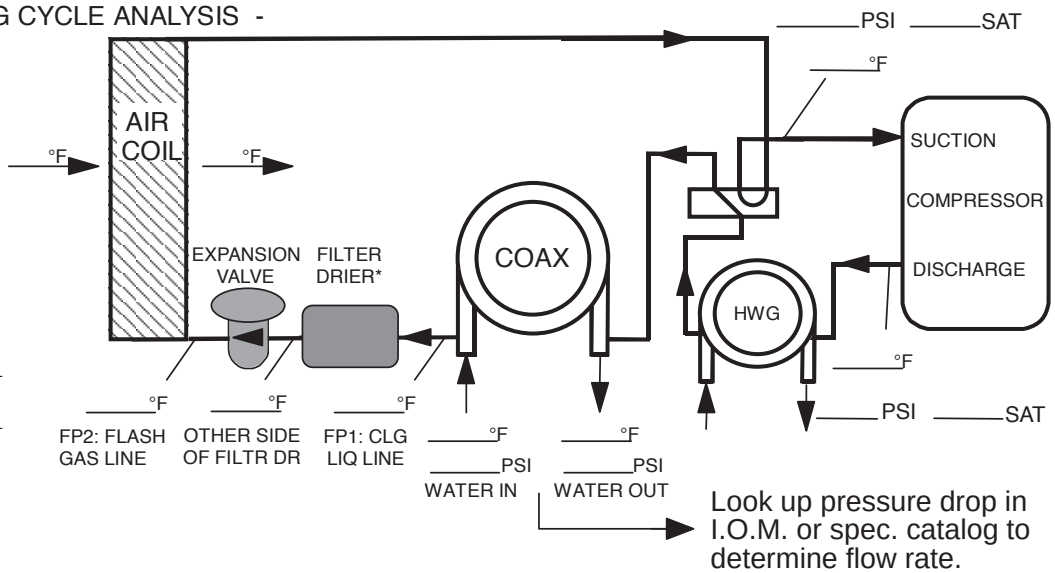
Allow unit to run 15 minutes in each mode before taking data.
Do not connect gauge lines

Functional Troubleshooting

HEATING CYCLE ANALYSIS -



COOLING CYCLE ANALYSIS -



Refrigerant Type:

HFC-410A

Voltage: _____

Comp Amps: _____

Total Amps: _____

Heat of Extraction (Absorption) or Heat of Rejection =

_____ flow rate (gpm) x _____ temp.diff. (deg. F) x _____ fluid factor† = _____ (Btu/hr)

Superheat = Suction temperature - suction saturation temp. = _____ (deg F)

Subcooling = Discharge saturation temp. - liquid line temp. = _____ (deg F)

† Use 500 for water, 485 for antifreeze.

Rev. 12/08

Note: Never connect refrigerant gauges during startup procedures. Conduct water-side analysis using P/T ports to determine water flow and temperature difference. If water-side analysis shows poor performance, refrigerant troubleshooting may be required. Connect refrigerant gauges as a last resort.

Tranquility® 20 (TS) Series

Rev.:02/05/14

Warranty (U.S. & Canada)

CLIMATEMASTER
Geothermal Heat Pump Systems

CLIMATE MASTER, INC.

LIMITED EXPRESS WARRANTY/ LIMITATION OF REMEDIES AND LIABILITY

It is expressly understood that unless a statement is specifically identified as a warranty, statements made by Climate Master, Inc., a Delaware corporation, ("CM") or its representatives, relating to CM's products, whether oral, written or contained in any sales literature, catalog or any other agreement, are not express warranties and do not form a part of the basis of the bargain, but are merely CM's opinion or commendation of CM's products.

EXCEPT AS SPECIFICALLY SET FORTH HEREIN, THERE IS NO EXPRESS WARRANTY AS TO ANY OF CM'S PRODUCTS. CM MAKES NO WARRANTY AGAINST LATENT DEFECTS. CM MAKES NO WARRANTY OF MERCHANTABILITY OF THE GOODS OR OF THE FITNESS OF THE GOODS FOR ANY PARTICULAR PURPOSE.

GRANT OF LIMITED EXPRESS WARRANTY
CM warrants CM products purchased and retained in the United States of America and Canada to be free from defects in material and workmanship under normal use and maintenance as follows: (1) All complete air conditioning, heating and/or heat pump units built or sold by CM for twelve (12) months from date of unit start up or eighteen (18) months from date of shipment (from factory), whichever comes first; (2) Repair and replacement parts, which are not supplied under warranty, for ninety (90) days from date of shipment (from factory). All parts must be returned to CM's factory in Oklahoma City, Oklahoma, freight prepaid, no later than sixty (60) days after the date of the failure of the part; if CM determines the part to be defective and within CM's Limited Express Warranty, CM shall, when such part has been either replaced or repaired, return such to a factory recognized dealer, contractor or service organization, F.O.B. CM's factory, Oklahoma City, Oklahoma, freight prepaid. The warranty on any parts repaired or replaced under warranty expires at the end of the original warranty period.

This warranty does not cover and does not apply to: (1) Air filters, fuses, refrigerant, fluids, oil; (2) Products relocated after initial installation; (3) Any portion or component of any system that is not supplied by CM, regardless of the cause of the failure of such portion or component; (4) Products on which the unit identification tags or labels have been removed or defaced; (5) Products on which payment to CM is or has been in default; (6) Products which have defects or damage which result from improper installation, wiring, electrical imbalance characteristics or maintenance; or are caused by accident, misuse or abuse, fire, flood, alteration or misapplication of the product; (7) Products which have defects or damage which result from a contaminated or corrosive air or liquid supply, operation at abnormal temperatures, or unauthorized opening of refrigerant circuit; (8) Mold, fungus or bacteria damages; (9) Products subjected to corrosion or abrasion; (10) Products manufactured or supplied by others; (11) Products which have been subjected to misuse, negligence or accidents; (12) Products which have been operated in a manner contrary to CM's printed instructions; or (13) Products which have defects, damage or insufficient performance as a result of insufficient or incorrect system design or the improper application of CM's products.

CM is not responsible for: (1) The costs of any fluids, refrigerant or other system components, or associated labor to repair or replace the same, which is incurred as a result of a defective part covered by CM's Limited Express Warranty; (2) The costs of labor, refrigerant, materials or service incurred in removal of the defective part, or in obtaining and replacing the new or repaired part; or, (3) Transportation costs of the defective part from the installation site to CM or of the return of any part not covered by CM's Limited Express Warranty.

Limitation: This Limited Express Warranty is given in lieu of all other warranties. If, notwithstanding the disclaimers contained herein, it is determined that other warranties exist, any such warranties, including without limitation any express warranties or any implied warranties of fitness for particular purpose and merchantability, shall be limited to the duration of the Limited Express Warranty.

LIMITATION OF REMEDIES
In the event of a breach of the Limited Express Warranty, CM will only be obligated at CM's option to repair the failed part or unit or to furnish a new or rebuilt part or unit in exchange for the part or unit which has failed. If after written notice to CM's factory in Oklahoma City, Oklahoma of each defect, malfunction or other failure and a reasonable number of attempts by CM to correct the defect, malfunction or other failure and the remedy fails of its essential purpose, CM shall refund the purchase price paid to CM in exchange for the return of the sold good(s). Said refund shall be the maximum liability of CM. **THIS REMEDY IS THE SOLE AND EXCLUSIVE REMEDY OF THE BUYER OR THEIR PURCHASER AGAINST CM FOR BREACH OF CONTRACT, FOR THE BREACH OF ANY WARRANTY OR FOR CM'S NEGLIGENCE OR IN STRICT LIABILITY.**

LIMITATION OF LIABILITY
CM shall have no liability for any damages if CM's performance is delayed for any reason or is prevented to any extent by any event such as, but not limited to: any war, civil unrest, government restrictions or restraints, strikes or work stoppages, fire, flood, accident, shortages of transportation, fuel, material, or labor, acts of God or any other reason beyond the sole control of CM. **CM EXPRESSLY DISCLAIMS AND EXCLUDES ANY LIABILITY FOR CONSEQUENTIAL OR INCIDENTAL DAMAGE IN CONTRACT, FOR BREACH OF ANY EXPRESS OR IMPLIED WARRANTY, OR IN TORT, WHETHER FOR CM's NEGLIGENCE OR AS STRICT LIABILITY.**

OBTAINING WARRANTY PERFORMANCE
Normally, the contractor or service organization who installed the products will provide warranty performance for the owner. Should the installer be unavailable, contact any CM recognized dealer, contractor or service organization. If assistance is required in obtaining warranty performance, write or call:

Climate Master, Inc. • Customer Service • 7300 S.W. 44th Street • Oklahoma City, Oklahoma 73179 (405) 745-6000

NOTE: Some states or Canadian provinces do not allow limitations on how long an implied warranty lasts, or the limitation or exclusions of consequential or incidental damages, so the foregoing exclusions and limitations may not apply to you. This warranty gives you specific legal rights, and you may also have other rights which vary from state to state and from Canadian province to Canadian province.

Please refer to the CM Installation, Operation and Maintenance Manual for operating and maintenance instructions.

Rev.: 11/09

LC083

Warranty (International)

CLIMATE MASTER, INC.
LIMITED EXPRESS WARRANTY /LIMITATION OF REMEDIES AND LIABILITY
(FOR INTERNATIONAL CLASS PRODUCTS)

CLIMATEMASTER®
Geothermal Heat Pump Systems

Disclaimer: It is expressly understood that unless a statement is specifically identified as a warranty, statements made by Climate Master, Inc., a Delaware corporation, U. S. A. ("CM") or its representatives, relating to CM's products, whether oral, written or contained in any sales literature, catalog, this or any other agreement or other materials, are not express warranties and do not form a part of the basis of the bargain, but are merely CM's opinion or commendation of CM's products. **EXCEPT AS SPECIFICALLY SET FORTH HEREIN AND TO THE FULLEST EXTENT PERMITTED BY APPLICABLE LAW, CM MAKES NO WARRANTY, AS TO ANY OF CM'S PRODUCTS, AND CM MAKES NO WARRANTY AGAINST LATENT DEFECTS OR ANY WARRANTY OF MERCHANTABILITY OF THE GOODS OR OF THE FITNESS OF THE GOODS FOR ANY PARTICULAR PURPOSE.**

GRANT OF LIMITED EXPRESS WARRANTY
CM warrants CM products purchased and installed outside the United States of America ("U.S.A.") and Canada to be free from material defects in materials and workmanship under normal use and maintenance as follows: (1) All complete air conditioning, heating or heat pump units built or sold by CM for twelve (12) months from date of unit start-up or eighteen (18) months from date of shipment (from CM's factory), whichever comes first; and, (2) Repair and replacement parts, which are not supplied under warranty, for ninety (90) days from date of shipment (from factory).

Warranty parts shall be furnished by CM if ordered through an authorized sales representative of CM ("Representative") within sixty (60) days after the failure of the part. If CM determines that a parts order qualifies for replacement under CM's warranty, such parts shall be shipped freight prepaid to the Representative or the ultimate user, as requested by Representative. All duties, taxes and other fees shall be paid by the ultimate user through the Representative.

If requested by CM, all defective parts shall be returned to CM's factory in Oklahoma City, Oklahoma, U.S.A. freight and duty prepaid, not later than sixty (60) days after the date of the request. If the defective part is not timely returned or if CM determines the part to not be defective or otherwise not to qualify under CM's Limited Express Warranty, CM shall invoice Customer the costs for the parts furnished, including freight. The warranty on any part repaired or replaced under warranty expires at the end of the original warranty period.

This warranty does not cover and does not apply to: (1) Air filters, fuses, refrigerant, fluids, oil; (2) Products relocated after initial installation; (3) Any portion or component of any system that is not supplied by CM, regardless of the cause of the failure of such portion or component; (4) Products on which the unit identification tags or labels have been removed or defaced; (5) Products on which payment by Customer to CM or its distributors or Representatives, or the Customer's seller is in default; (6) Products which have defects or damage which result from improper installation, wiring, electrical imbalance characteristics or maintenance; or from parts or components manufactured by others; or are caused by accident, misuse, negligence, abuse, fire, flood, lightning, alteration or misapplication of the product; (7) Products which have defects or damage which result from a contaminated or corrosive air or liquid supply, operation at abnormal temperatures or flow rates, or unauthorized opening of the refrigerant circuit; (8) Mold, fungus or bacteria damages; (9) Products subjected to corrosion or abrasion; (10) Products, parts or components manufactured or supplied by others; (11) Products which have been subjected to misuse, negligence or accidents; (12) Products which have been operated in a manner contrary to CM's printed instructions; (13) Produce which have defects, damage or insufficient performance as a result of insufficient or incorrect system design or the improper application, installation, or use of CM's products; or (14) Electricity or fuel costs, or any increases or unrealized savings in same, for any reason.

CM is not responsible for: (1) The cost of any fluids, refrigerant or other system components, or the associated labor to repair or replace the same, which is incurred as a result of a defective part covered by CM's Limited Express Warranty; (2) The cost of labor, refrigerant, materials or service incurred in diagnosis and removal of the defective part, or in obtaining and replacing the new or repaired part; (3) Transportation costs of the defective part from the installation site to CM or of the return of any part not covered by CM's Limited Express Warranty; or (4) The costs of normal maintenance.

Limitation: This Limited Express Warranty is given in lieu of all other warranties. If, notwithstanding the disclaimers contained herein, it is determined by a court or other qualified judicial body that other warranties exist, any such warranty, including without limitation any express warranty or any implied warranty of fitness for particular purpose and merchantability, shall be limited to the duration of the Limited Express Warranty. This Limited Express Warranty does not exclude any warranty that is mandatory and that may not be excluded under applicable imperative law.

LIMITATION OF REMEDIES
In the event of a breach of this Limited Express Warranty or any warranty that is mandatory under applicable imperative law, CM will only be obligated at CM's option to either repair the failed part or unit or to furnish a new or rebuilt part or unit in exchange for the part or unit which has failed. If after written notice to CM's factory in Oklahoma City, Oklahoma, U.S.A. of each defect, malfunction or other failure and a reasonable number of attempts by CM to correct the defect, malfunction or other failure and the remedy fails of its essential purpose, CM shall refund the purchase price paid to CM in exchange for the return of the sold good(s). Said refund shall be the maximum liability of CM. **TO THE FULLEST EXTENT PERMITTED BY APPLICABLE LAW, THIS REMEDY IS THE SOLE AND EXCLUSIVE REMEDY OF THE CUSTOMER AGAINST CM FOR BREACH OF CONTRACT, FOR THE BREACH OF ANY WARRANTY OR FOR CM'S NEGLIGENCE OR IN STRICT LIABILITY.**

LIMITATION OF LIABILITY
CM shall have no liability for any damages if CM's performance is delayed for any reason or is prevented to any extent by any event such as, but not limited to: any war, civil unrest, government restrictions or restraints, strikes, or work stoppages, fire, flood, accident, allocation, shortages of transportation, fuel, materials, or labor, acts of God or any other reason beyond the sole control of CM. **TO THE FULLEST EXTENT PERMITTED BY APPLICABLE LAW AND SUBJECT TO THE NEXT SENTENCE, CM EXPRESSLY DISCLAIMS AND EXCLUDES ANY LIABILITY FOR LOSS OF PROFITS, LOSS OF BUSINESS OR GOODWILL, CONSEQUENTIAL, INCIDENTAL, SPECIAL, LIQUIDATED, OR PUNITIVE DAMAGE IN CONTRACT, FOR BREACH OF ANY EXPRESS OR IMPLIED WARRANTY, OR IN TORT, WHETHER FOR CM's NEGLIGENCE OR AS STRICT LIABILITY.** Nothing in this Agreement is intended to exclude CM's liability for death, personal injury or fraud.

OBTAINING WARRANTY PERFORMANCE
Normally, the contractor or service organization who installed the products will provide warranty performance for the owner. Should the installer be unavailable, contact any CM recognized Representative. If assistance is required in obtaining warranty performance, write or call:

Climate Master, Inc. • Customer Service • 7300 S.W. 44th Street • Oklahoma City, Oklahoma. U.S.A. 73179 • (405) 745-6000 • FAX (405) 745-6068

NOTE: Some countries do not allow limitations on how long an implied warranty lasts, or the limitation or exclusions of consequential or incidental damages, so the foregoing exclusions and limitations may not apply to you. This warranty gives you specific legal rights, and you may also have other rights which vary from state to state and country to country.

Please refer to the CM Installation, Operation and Maintenance Manual for operating and maintenance instructions.

Rev.: 10/09

LCO79

Tranquility® 20 (TS) Series

Rev.:02/05/14

Revision History

Date:	Item:	Action:
02/05/14	All	Updated sizes 024-070 to Rev. C
10/07/13	Figure 10a: Vertical Condensate Drain	Updated
07/17/13	Wiring Diagrams and EAT Limit ClimaDry®	Updated
11/09/12	POE Oil Warning	Added
09/27/12	Water Quality Table Condensate Drain Connection EAT Limits	Updated Updated Updates to Text - ClimaDry® Option
04/16/12	All	Updated ClimaDry® II Information
08/09/11	Unit Maximum Working Water Pressure	Updated to Reflect New Safeties
08/01/11	First Published	

ISO 9001:2008 Certified
Quality: First & Always

97B0075N06

ClimateMaster
Water-Source Heat Pump Systems
7300 S.W. 44th Street
Oklahoma City, OK 73179
Phone: 405-745-6000
Fax: 405-745-6058
climatemaster.com

ClimateMaster works continually to improve its products. As a result, the design and specifications of each product at the time for order may be changed without notice and may not be as described herein. Please contact ClimateMaster's Customer Service Department at 1-405-745-6000 for specific information on the current design and specifications. Statements and other information contained herein are not express warranties and do not form the basis of any bargain between the parties, but are merely ClimateMaster's opinion or commendation of its products.

The management system governing the manufacture of ClimateMaster's products is ISO 9001:2008 certified.

ClimateMaster is a proud supporter of the Geothermal Exchange Organization - GEO. For more information visit geoexchange.org.

© ClimateMaster, Inc. 2009